MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

# Highway 169 Corridor Study

## Identification and Evaluation of Corridor Concepts

**Date:** November 29, 2021

**To:** Project Management Team

**From:** Angie Bersaw, AICP Deputy Project Manager, Bolton & Menk, Inc.

Ashley Hudson, AICP Transportation Planner, Bolton & Menk, Inc.

**Subject:** Final Concept Development and Evaluation Memo

Highway 169 Corridor Study

Mankato/North Mankato Area Planning Organization (MAPO) and Minnesota Department of Transportation (MnDOT)

BOLTON & MENK
Real People. Real Solutions.

# Table of Contents



## List of Figures



## List of Tables

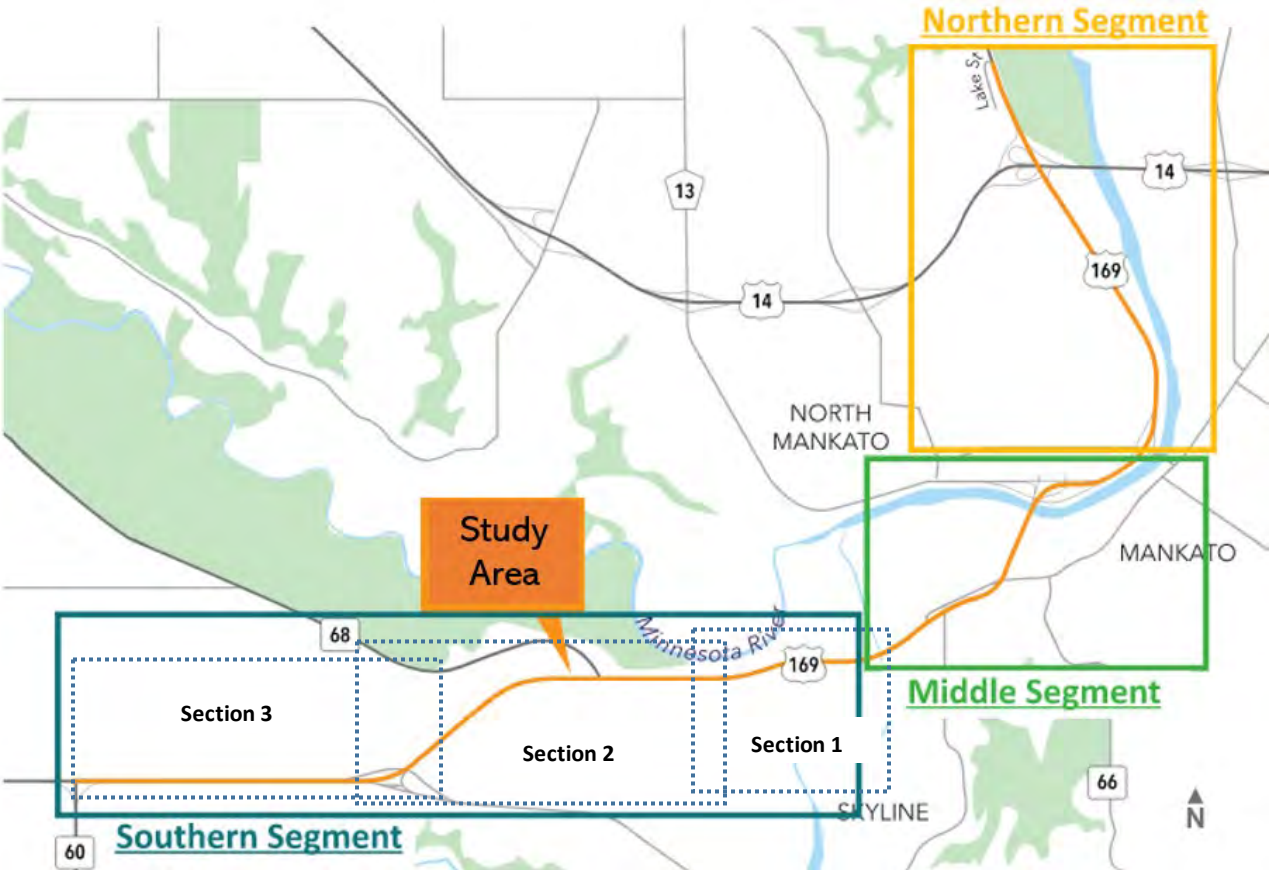


## Appendices

# I. Introduction

Representatives from the Mankato/North Mankato Area Planning Organization (MAPO) and the Cities of North Mankato, Mankato, Blue Earth County, Nicollet County, and the Minnesota Department of Transportation (MnDOT) made up a Project Management Team (PMT) that developed improvement concepts on Highway 169, and the surrounding local network. The study area extents included Lake Street at the north and Highway 60 at the south as shown in **Figure 1**. For ease in describing key corridor/network needs, the study area was split into three subareas based on the unique context within each. The northern, middle, and southern subareas and for the same reasons the southern subarea was split into three sections. The subareas are also shown in **Figure 1**.

**Figure 1. Study Extents and Subareas**




Multiple improvement concepts were identified and evaluated based on the existing conditions analysis, purpose and need, and issues and needs identified through public, agency and stakeholder involvement. The memo describes and documents concepts evaluated for each subarea of Highway 169.

# II. Initial Concepts List

The list below represents all concepts considered for each subarea. A discussion of concepts can also be seen in the Concept Traffic Operations Memorandum in **Appendix B.**

**Northern Subarea**

A. Signalized Green T intersection at eastbound Highway 14 exit ramp
B. Combine River Lane/Lind Street and maintain Webster Avenue
    i. Signalized intersection at River Lane/Lind Street and Webster Avenue
    ii. Roundabout intersections at River Lane/Lind Street and Webster Avenue
    iii. Signalized Reduced Conflict U-Turns (RCUTs) at River Lane/Lind Street and Webster Avenue
C. Combined intersection – Lind Street, River Lane, Webster Avenue
D. Highway 169/Highway 14 Interchange
    i. Full cloverleaf
    ii. Eliminate south loop with a signalized intersection
    iii. Eliminate south loop with a roundabout intersection
    iv. Diverging Diamond
    v. Roundabout ramp intersections
E. Local connection improvements
    i. Range Street remain open with modifications to lane striping/utilization
    ii. Range Street Right-In/Right-Out (RIRO) Intersection
    iii. Range Street cul-de-sac
    iv. Monroe Avenue – check sight distance and determine need for intersection
F. Pedestrian considerations
    i. Future trail connection across Highway 169 and Minnesota River using the existing Highway 14 bridge and including connections to Rex Macbeth Trail and the Minnesota River Trail
    ii. Possible new grade separated crossing north of Lind Street
    iii. Possible new grade separated crossing at Webster Avenue

**Middle Subarea**

A. Veteran's Memorial Bridge/Belgrade Avenue/Highway 169 Interchange
    i. Westbound lane reduction and pedestrian crossing improvements
    ii. Roundabout at western interchange ramp terminal

B. Riverfront Drive/Highway 169 Interchange

    i. Right Turn Lane Concept - Add channelized westbound right turn lane at northbound Highway 169 entrance ramp, tighten right turn, pedestrian crossing improvements, close local accesses off Riverfront Drive
    ii. Signalized Corridor Concept - Triple left from southbound Highway 169, additional eastbound through lane under the bridge which becomes a right turn lane at Poplar Street, additional entrance ramp lane for northbound Highway 169
    iii. Riverfront Drive West of Highway 169 Concept - Loop ramp from southbound Highway 169 eliminating access off Hubbell Avenue onto Riverfront Drive, roadway extension of

2nd Street from Owatonna Street to Hubbell Avenue and 3rd Street between Sibley Street and Hubbell Avenue, additional entrance ramp for northbound Highway 169

**Southern Subarea**

A. Section 1: Blue Earth River bridge to CSAH 33 (Hemlock Road)
   i. Concept A – Maintain 3/4 access at Hawley Street, restrict access at Amos Owen Lane and CSAH 33 by removing side street left turns (convert to RCUTs), install U turns between CSAH 33/McCauley Street and Amos Owen Lane/Hawley Street to accommodate lefts, potentially eliminate CSAH 33 access with new access south of Highway 68 or realign with Hemlock Road.
   ii. Concept B – eastbound right-in only at Hawley Street, restrict access at Amos Owen Lane and CSAH33 by removing side street left turns (convert to RCUT), install U turns between CSAH 33/Amos Owen Lane and Amos Owen Lane/Hawley Street to accommodate lefts, potentially eliminate CSAH 33 access with new access south of Highway 68 or realign with Hemlock Road.
   iii. Concept C – Full access signalized Green-T intersection at Hawley Street, restrict access at Amos Owen Lane by removing side street left turns (convert to RCUT), use U turn between CSAH 33/Amos Owen Lane to accommodate lefts, restrict access at CSAH 33 to RIRO
   iv. Concept D – Full access signalized Green-T intersection at CSAH 33, restrict access at Amos Owen Lane by removing side street left turns (convert to RCUT), install U turn between CSAH 33/Amos Owen Lane to accommodate lefts, restrict access at Hawley Street to RIRO
   v. Grade separated pedestrian crossings
      - Overpass at Hawley Street
      - Underpass at Blue Earth River Bridge

B. Section 2: Highway 68 to CSAH 90
   i. Concept A - Maintain existing access locations, construct High-T at Highway 68, restrict direct access to Highway 169 for businesses, restrict left turns at County Road 120 and CSAH 69, install U turn between County Road 120 and CSAH 69 to accommodate westbound left turn from T-943, close Bison Street access
   ii. Concept B1 – Construct High-T at Highway 68, consolidate access near CSAH 69 to provide better access spacing, construct connector roads to direct local traffic to new access location, close County Road 120 and Bison Street accesses
   iii. Concept B2 - Consolidate access between County Road 120 and CSAH 69 to provide better access spacing, construct connector roads to direct local traffic to new access location, close Bison Street access, reduce access at Highway 68 to RIRO
   iv. Concept C - Use RCUTs for County Road 120 and CSAH 69, add south leg to Highway 68 intersection, close Bison Street access

C. Section 3: CSAH 90 to the Highway 169/60 intersection
   i. Concept A - Close access at 208th Lane and Loren Drive, restrict northbound left turn at Highway 60/Highway 169 intersection, install U turns between Loren Drive/County Road 117 and west of Highway 60/Highway 169 intersection to accommodate lefts, reduce access at Gadwall Road to RIRO

ii. Concept B - Realign access at Gadwall Road to provide better access spacing, close access at 208th Lane, Loren Drive and County Road 117, construct connector road to connect County Road 117 with the new Gadwall Road access location

# III. Early Concepts Screening

**Table 1** below describes reasons for early dismissal of concepts that showed fatal flaws in comparison against the study's goals and objectives and purpose and need. The early screening process was conducted and documented by the PMT and shared with the public. The concepts dismissed below were not carried forward into the detailed concept evaluation. See the **Appendix D** for sketches of the dismissed concepts.

**Table 1. Dismissed Concepts**

| Dismissed Concepts | Reason Dismissed* |
|---|---|
| **Northern Subarea** | |
| **Signalized Green T at the eastbound Highway 14 exit ramp** | • Early layout of this concept showed the northbound left turn lane to westbound Highway 14 located too close to the Highway 169 and eastbound Highway 14 exit ramp intersection. Specifically, the crossover between the eastbound left traffic from the eastbound Highway 14 exit ramp and the northbound left traffic at the westbound Highway 14 entrance ramp is a crash concern |
| **Combined intersection – Lind Street, River Lane, Webster Avenue** | • Concept is too impactful to existing businesses and future redevelopment areas and would require significant local road network reconfiguration |
| **Southern Subarea** | |
| **Section 1 – Concept A:** Maintain existing access, convert to RCUTs, modify geometry at Hawley Street to improve safety | • Operational issues – Westbound left turns at Hawley Street and at CSAH 33 operate with failing LOS |
| **Section 1 – Concept B:** Restrict access at Hawley Street, RCUTs at CSAH 33 and Amos Owen Lane | • Operational issues – Westbound left turns at CSAH 33 and westbound U-Turns at RCUTs operate with failing LOS |

**The supporting traffic and safety analyses are documented in the Concept Traffic Operations Memo in Appendix B.*

# IV. Detailed Evaluation of Concepts

Following the early screening process, concepts carried forward were run through an evaluation matrix. Each subarea evaluation matrix scored concepts on their ability to achieve study goals and concept scores were compared to the no-build and each other to determine which perform best. The northern and southern subarea evaluation matrices are included in **Appendix A**. Local system improvements and grade separated pedestrian crossing were also evaluated in the northern subarea. In addition, the southern subarea evaluated grade separated pedestrian crossings. Matrices for these can also be found on the following pages.

Study Goals and Objectives

Table 2 shows the study goals and objectives used for the detailed evaluation of concepts. Not all objectives were relevant to each subarea or evaluation of local system improvements. Refer to each subarea matrix in **Appendix A** for the objectives relevant to each subarea and concept.

**Table 2. Study Goals and Objectives**

| Study Goals | Goal Objectives |
|---|---|
| **Goal A: Preserve community connections and economic vitality.** | • Maintain sustainable access for local trips into/out of Mankato and North Mankato<br>• Maintain emergency access routes into/out of Mankato and North Mankato<br>• Accommodate reasonable vehicle/truck access<br>• Accommodate reasonable pedestrian/bicycle access<br>• Enhance community identity |
| **Goal B: Provide efficient and reliable mobility for all users.** | • Provide acceptable system reliability serving existing and planned growth<br>• Provide acceptable regional highway travel times while accommodating reliable local access<br>• Provide acceptable side street delay<br>• Improves side street delay over existing conditions<br>• Understand and plan for freight needs<br>• Meet access spacing guidelines<br>• Improve access spacing guidelines over existing conditions<br>• Provide a connected transportation system that accommodates trips consistent with roadway functional classification<br>• Perceived pedestrian/bicyclist level of comfort<br>• Accommodate future transit plans and needs<br>• Understand and plan for roadway expansion |

| | |
|---|---|
| **Goal C: Safely accommodate all system users.** | • Reduce crash and severity rates<br>• Provide safe pedestrian and bicycle travel near and across roadways, to area schools, and to regional destinations. |
| **Goal D: Provide infrastructure improvements that respect the environment.** | • Avoid, minimize, and mitigate impacts to sensitive environmental resources<br>• Avoid, minimize, and mitigate impacts to hazardous contaminated areas<br>• Disproportionate impact to Environmental Justice (EJ) populations |
| **Goal E: Develop a financially responsible implementation plan.** | • Right-size improvements to address needs yet maximize use of existing infrastructure where possible<br>• Develop fiscally responsible improvements (construction costs)<br>• Develop fiscally responsible improvements (right-of-way and environmental impact costs)<br>• Develop project phases that meet schedule and funding constraints and maximize opportunities<br>• Develop a supported funding model to clearly identify agency responsibilities<br>• Position partner agencies to seek federal and state grants for identified improvements to minimize partner costs |
| **Goal F: Develop a plan supported by all agency partners.** | • Supported by the Project Management Team (PMT) |

Additional Concepts Dismissed

After further traffic analysis, it was determined that the concepts below have concerning operational issues and the PMT decided to dismiss each. **Table 3** provides reasoning for concepts dismissed early.

**Table 3. Additional Concepts Dismissed**

| Dismissed Concepts | Reason Dismissed* |
|---|---|
| **Northern Subarea** | |
| **Highway 169/Highway 14 Interchange - Eliminate north loop with a roundabout intersection** | • Operational issues - Maximum queues along exit ramp are anticipated to extend onto mainline Highway 14 and delay for the exit ramp movements operates with failing LOS |
| **Highway 169/Highway 14 Interchange - Eliminate south loop with a roundabout intersection** | • Operational issues - Maximum queues along exit ramp are anticipated to extend onto mainline Highway 14 and delay for the exit ramp movements operates with failing LOS |

**The supporting traffic and safety analyses are documented in the Concept Traffic Operations Memo in Appendix B.*

The Middle Subarea

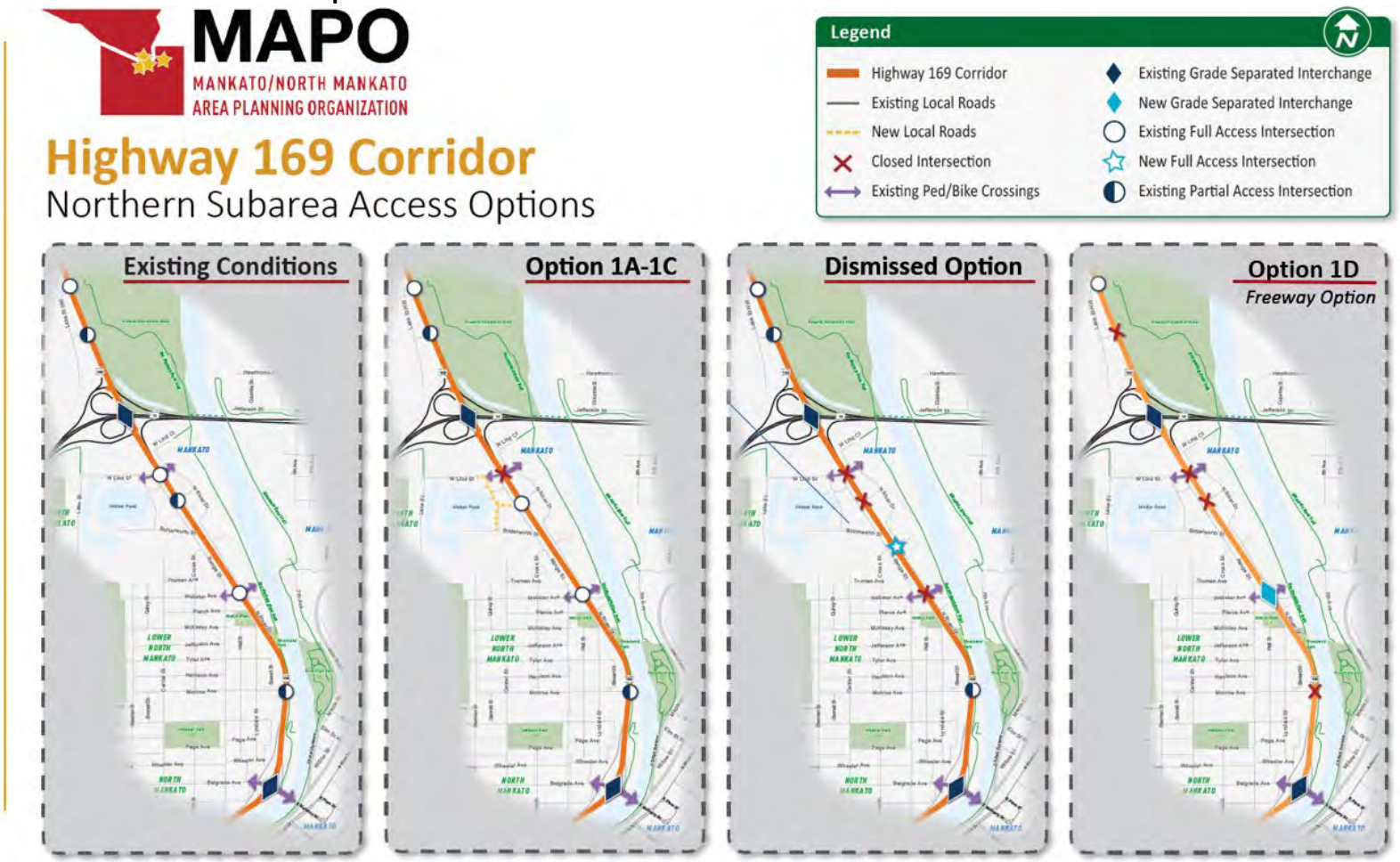
Concepts considered for the middle subarea included newly developed lower cost concepts and concepts identified in the previous Riverfront Drive and Belgrade Avenue Corridor Studies. In the early stage of the detailed concept evaluation, MnDOT announced the middle subarea would be best addressed through the scoping process of an upcoming Veterans Memorial Bridge project. MnDOT and the cities of Mankato and North Mankato will utilize the concepts developed for this subarea and engage in further analysis and public input to determine a preferred alternative for the upcoming project. For this reason, the middle subarea concepts were not carried through the detailed evaluation process. However, the PMT requested that concepts be documented for consideration in the upcoming MnDOT project scoping effort. See documented concepts in **Appendix C**.

# V. Northern Subarea Evaluation

The following pages include images, descriptions, and summaries of scores for each concept. This also depicts how concepts were presented to the public. Full copies of the concept drawings can be seen on the MAPO website (www.mnmapo.org)

**Figure 2** below provides a high-level overview for each Northern Subarea concept. Concepts 1A-1C all close Lind Street and relocate a full access intersection to North River Lane with either traffic signals, reduced conflict U-turns (RCUTS), or roundabouts. As discussed in Section III, Early Concept Screening, the study team looked at combining Lind Street, North River Lane, and Webster Avenue into one intersection but dismissed the idea because it was too impactful to businesses and properties to fit in the local road reconfigurations needed to support it. Concept 1D converts this section of Highway 169 into a freeway by completing the cloverleaf at the Highway 169/14 interchange and adding a grade separated interchange at Webster Avenue. Not shown in this graphic, but the study team also looked at other Highway 169/14 interchange improvements such as a ramp signal and a Diverging Diamond interchange. These other Highway 169/14 interchange improvements are shown on the follow pages and can be paired with a 1A-C concept.

**Figure 2. Northern Subarea Access Concepts**



## Northern Subarea Concepts

No-Build Concept

With every transportation improvement study, a "no-build" concept is evaluated to justify the need for any improvement investments. The “no-build” or existing conditions concept is shown in **Figure 3**. This evaluation looks at what will happen over the next 20 years if no transportation improvements are made but the communities and region continue to grow as planned.

The “no-build” concept was evaluated against the study goals and given an overall score. The no-build scored very poorly with a negative score (-63 out of a possible 291 points) due to the many project goals it did not address. This justified to the study team that "doing nothing" is not a viable concept. The following is a high-level summary as to why. See the Traffic Operations Memo in **Appendix B** for more details.

- 2040 traffic projections show excessive delays at the eastbound Highway 14 ramp during peak traffic hours.
- Five of seven intersections are spaced closer than MnDOT access spacing guidelines recommend
- There were a high number of crashes, 159 total with two severe, between 2015 and 2019. With anticipated traffic growth this would worsen.
- Crashes at the Lind Street intersection are more than three times the normal range for similar intersections.
- Local business access is very important in this subarea and council resolutions reinforce this.
- There is a demand for pedestrian and bicycle access across Highway 169 to connect the existing trail systems at Lind Street and Webster Avenue.

**Figure 3. Northern Subarea No-Build Concept**

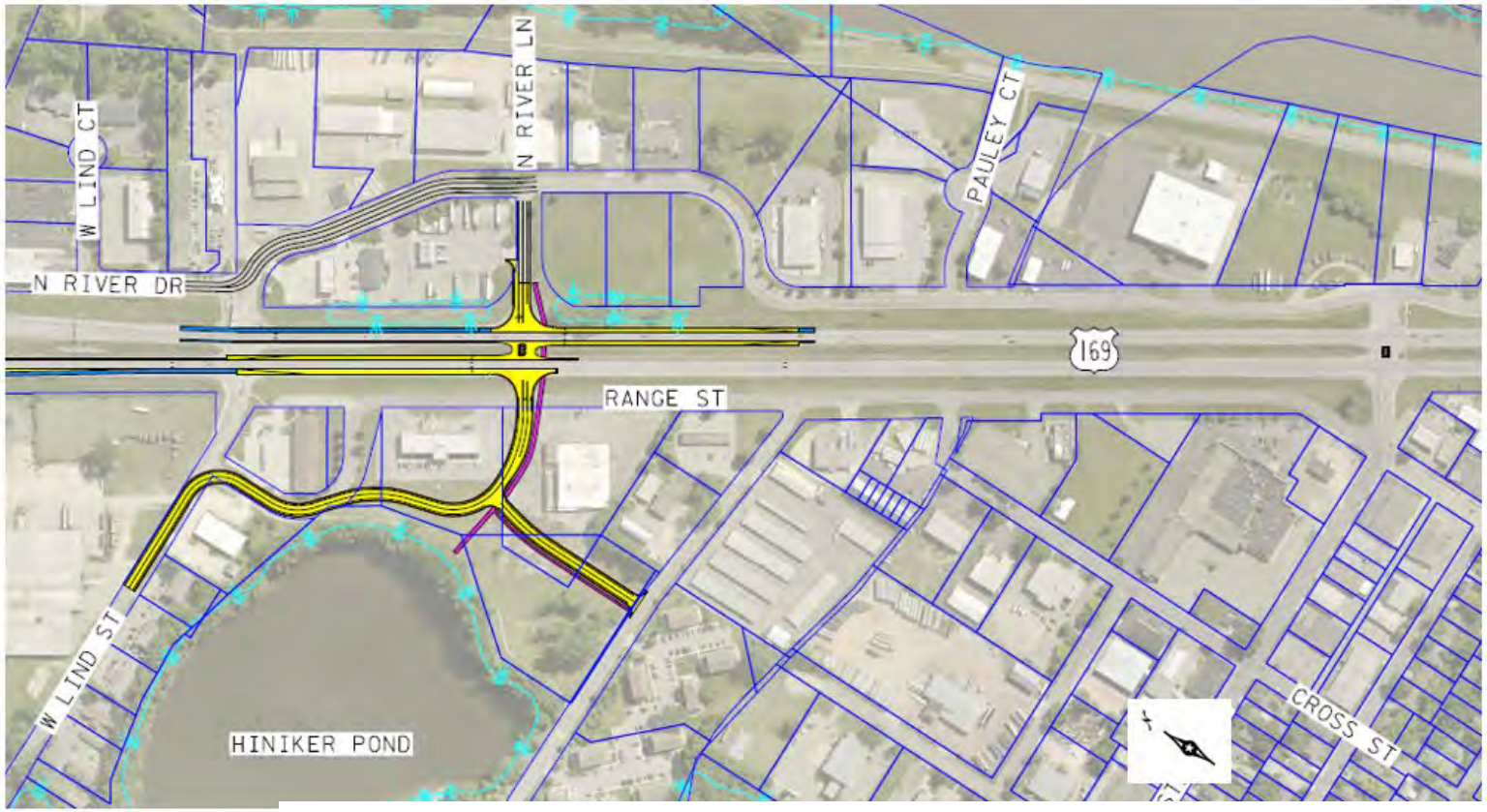



MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

## Northern Subarea Concepts

Concept 1A – Combine River Lane/Lind Street and Maintain Webster Avenue (Signals)




**CONCEPT EVALUATION**

GOOD ++ FAIR + POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | + |
| Safety for all users | - |
| Community & environmental impacts | + |
| Fiscally responsible $3.7M | + |
| Agency support | ++ |

SCORE 135

### Summary of Evaluation:

Goal A: All movements are maintained at intersections accommodating reasonable access.

Goal B: Close access spacing to Highway 14 ramps. Average side street delay is increased from the no build scenario.

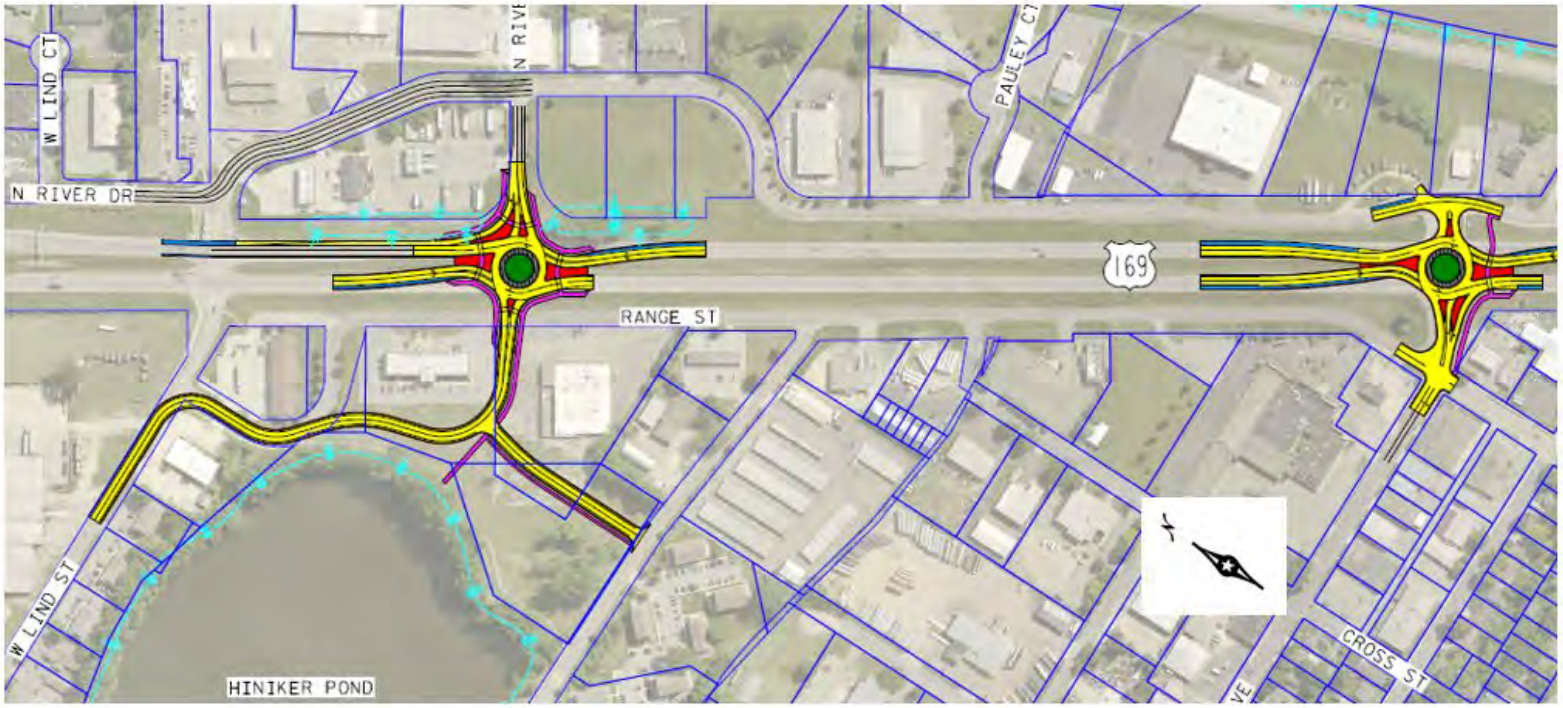
Goal C: Retaining traffic signal would not reduce crash/severity rates.

Goal D: New road alignment north of Hiniker Pond and Highway 14 ramp adjustments pose medium risk for impacts that will need to be studied with a future project. Based on environmental screening there are several hazardous waste areas south of the Highway 14 interchange, most south of Hiniker Pond.

Goal E: A fair fiscally responsible score is applied here because the concept's lack of addressing safety issues makes it less competitive for funding programs. Also, the cost estimate does not cover all partial property impacts or any easements necessary.

## Northern Subarea Concepts

Concept 1B – Combine River Lane/Lind Street and Maintain Webster Avenue (Roundabouts)




**CONCEPT EVALUATION**

| ++ GOOD | + FAIR | - POOR |
|---|---|---|

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | + |
| Safety for all users | ++ |
| Community & environmental impacts | + |
| Fiscally responsible $7.3M | ++ |
| Agency support | ++ |

**SCORE 202.5**

### Summary of Evaluation:

Goal A: All movements are maintained at intersections accommodating reasonable access. Median areas provide opportunity for aesthetics/monumentation.

Goal B: Close access spacing to Highway 14 ramps. Average side street delay is reduced from the no build scenario.

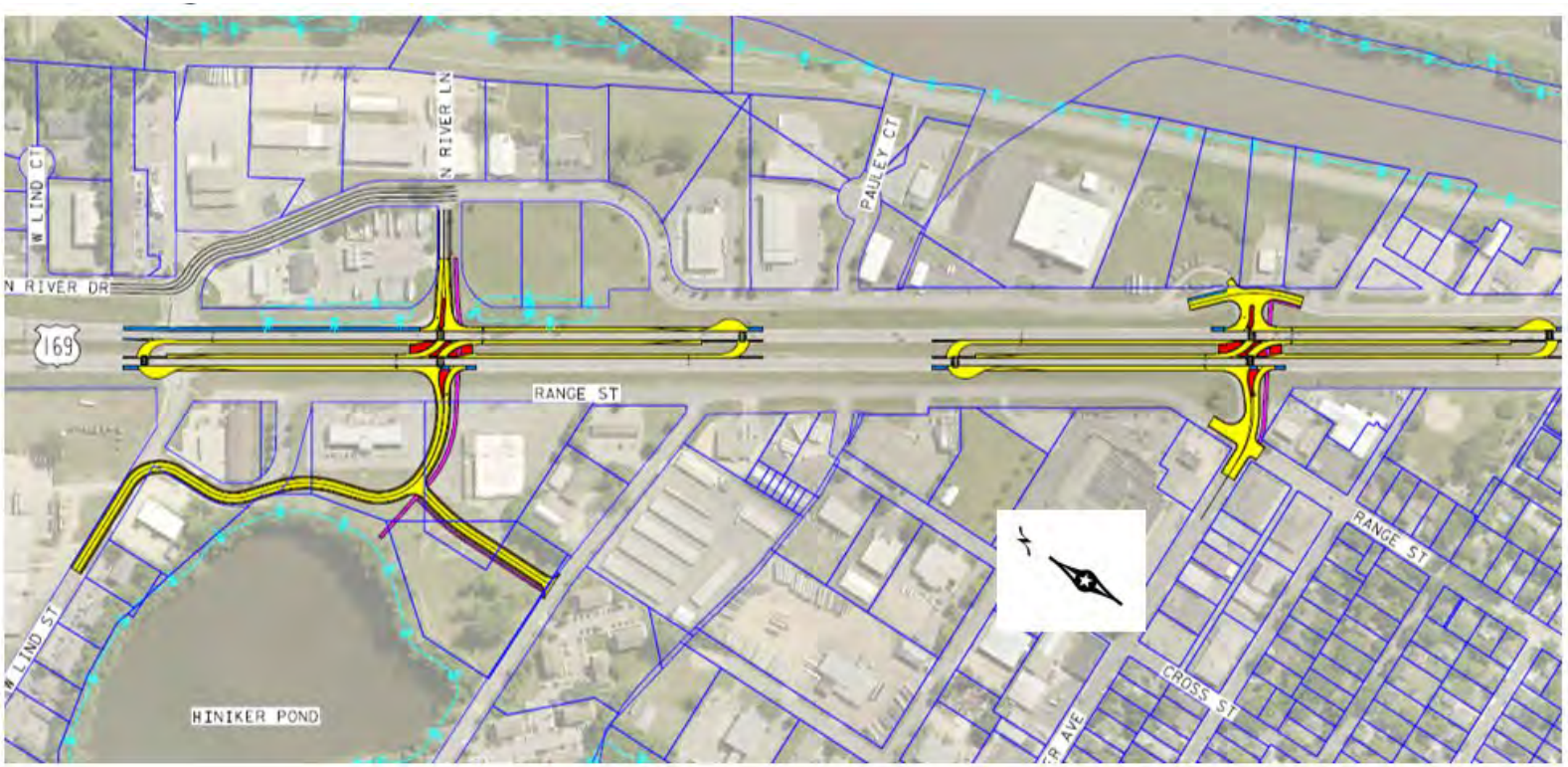
Goal C: Roundabouts reduce crash severity rates and pedestrian/vehicle conflict points.

Goal D: New road alignment north of Hiniker Pond and Highway 14 ramp adjustments pose medium risk for impacts that will need to be studied with a future project. Based on environmental screening there are several hazardous waste areas south of the Highway 14 interchange, most south of Hiniker Pond. Intersection improvements at both River Lane and Webster Avenue have larger disturbance footprint in this area.

Goal E: A good fiscally responsible score is applied here because the concept's ability to address safety issues makes it more competitive for funding programs. Also, the cost estimate does not cover all partial property impacts or any easements necessary.

## Northern Subarea Concepts

Concept 1C – Combine River Lane/Lind Street and Maintain Webster Avenue (RCUTs)




CONCEPT EVALUATION

GOOD ++ FAIR + POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | - |
| Mobility for all users | + |
| Safety for all users | + |
| Community & environmental impacts | + |
| Fiscally responsible $8.6M | + |
| Agency support | + |

SCORE 115

### Summary of Evaluation:

Goal A: Sightline concerns with plantings in RCUT medians. Side street movements are restricted so reasonable access is not perceived as being accommodated.

Goal B: Close access spacing to Highway 14 ramps. Average side street delay is the same as the no build scenario.

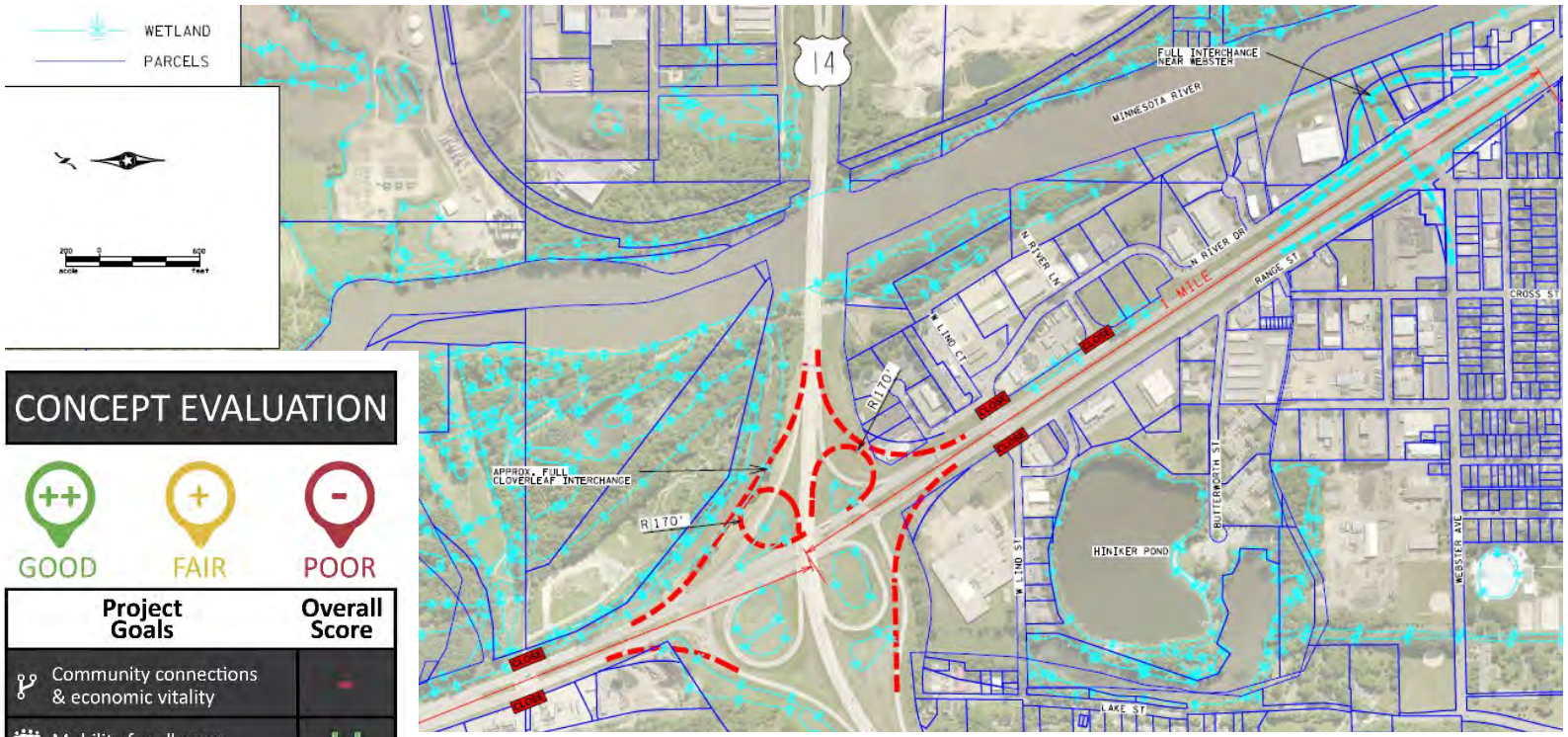
Goal C: RCUTs have been shown to reduce crash/severity rates. RCUTs are perceived as confusing for pedestrians and bicyclists.

Goal D: New road alignment north of Hiniker Pond and Highway 14 ramp adjustments pose medium risk for impacts that will need to be studied with a future project. Based on environmental screening there are several hazardous waste areas south of the Highway 14 interchange, most south of Hiniker Pond. Intersection improvements at both River Lane and Webster Avenue have larger disturbance footprint in this area.

Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.

## Northern Subarea Concepts

Concept 1D – Webster Ave Interchange and 2A – Highway 14/169 Interchange (Full Cloverleaf)




**CONCEPT EVALUATION**

GOOD ++ | FAIR + | POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | - |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | - |
| Fiscally responsible - $25M | - |
| Agency support | - |

SCORE 156

**CONCEPT EVALUATION**

GOOD ++ | FAIR + | POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | - |
| Mobility for all users | ++ |
| Safety for all users | - |
| Community & environmental impacts | - |
| Fiscally responsible - $13M | - |
| Agency support | + |

SCORE 31.5

### Summary of Evaluation:

Goal A: Freeway will result in increased travel time from Highway 14 to area around McDonalds and Lind Street. Large cloverleaf footprint provides limited opportunities for aesthetic improvements.

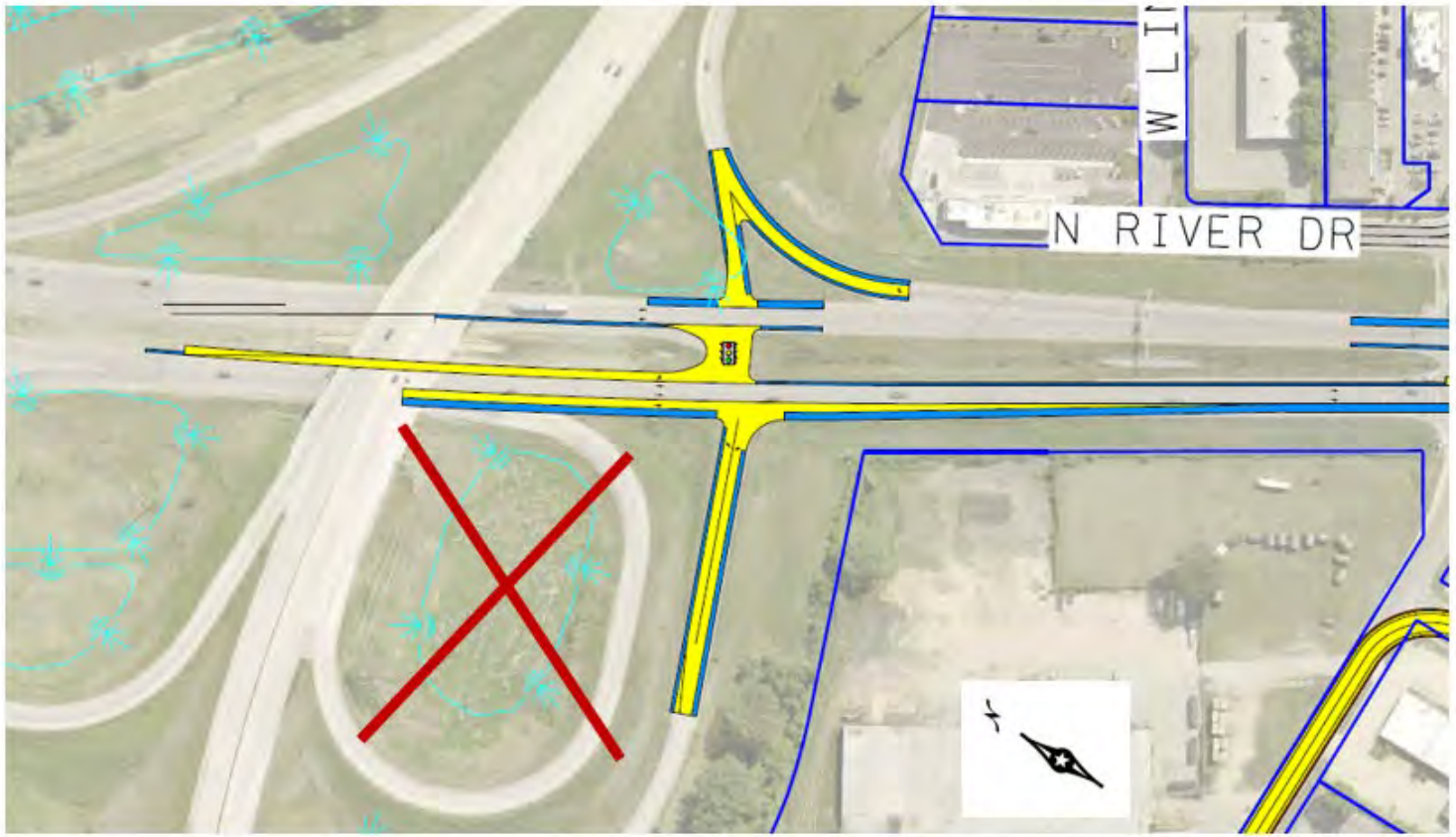
Goal C: Full cloverleaf introduces new weave areas.

Goal D: Highway 14 West to Highway 169 ramp would impact the existing wetland in the northeast quadrant. - Highway 169 North to Highway 14 East ramp would impact McDonald's building. - The full interchange configuration Concept 2A would warrant modifications to the Minnesota River levee that protects the City of Mankato and North Mankato from flood waters produced by the Minnesota River. Further coordination with FEMA will be required to understand the requirements associated with levee modifications or relocations associated with Concept 2A. - Based on environmental screening there are several hazardous waste areas south of the Highway 14 interchange, most south of Hiniker Pond. An interchange at Webster Avenue would have a larger disturbance footprint in this area. North Mankato Resolution No. No. R-19-0708-119 states at-grade access must be preserved at Webster Avenue. For this reason, this option would fail goal F, as it would not be supported by the PMT.

Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.

## Northern Subarea Concepts

Concept 2C – Highway 14/169 Interchange (Eliminate South Loop - Signal)




**CONCEPT EVALUATION**

GOOD ++ | FAIR + | POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | ++ |
| Safety for all users | + |
| Community & environmental impacts | ++ |
| Fiscally responsible - $2.5M | ++ |
| Agency support | ++ |

SCORE 183

### Summary of Evaluation:

Goal B: Average side street delay is significantly reduced from the no build scenario.

Goal C: Increase in total number of crashes anticipated with adding traffic signal.

Goal D: Alone poses low risk and further evaluation needed relative to what it is paired with for improvements to the south.

Goal A and E showed minimal to no differentiating impact.

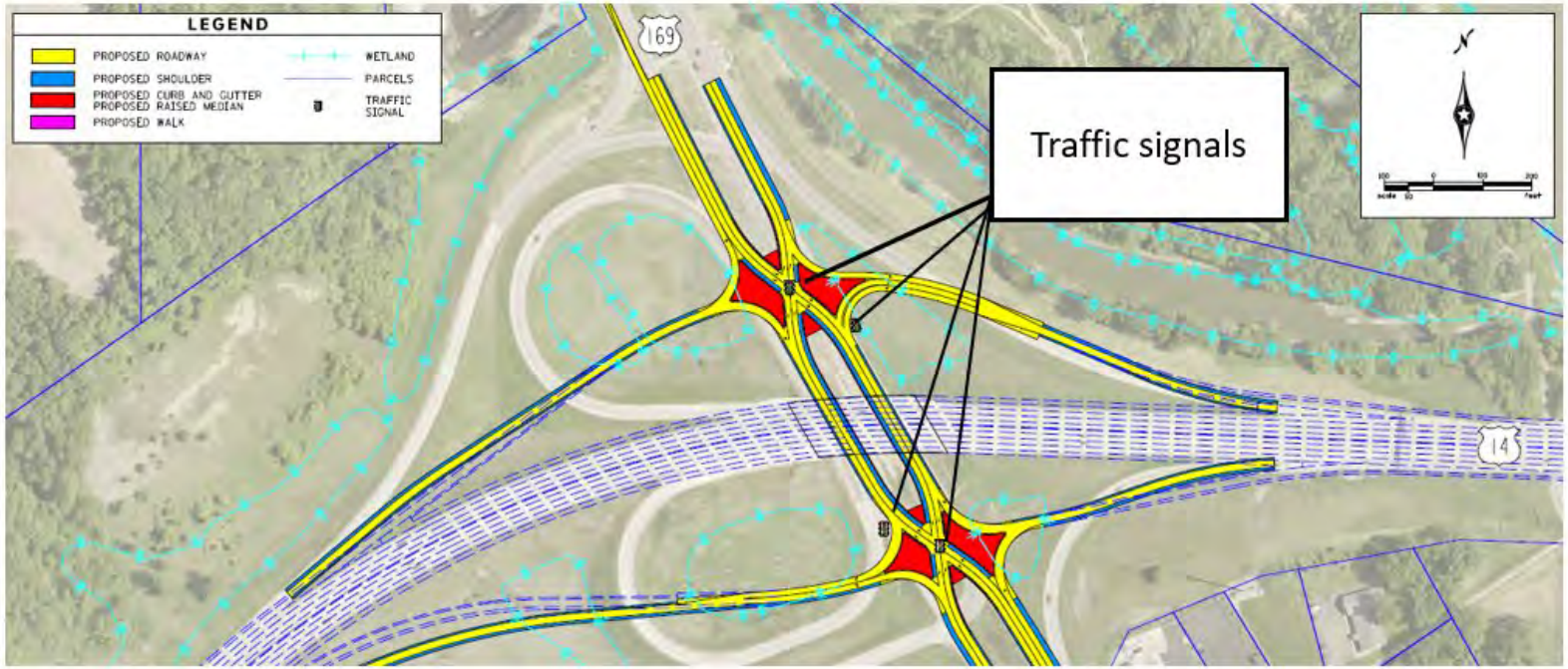


MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

## Northern Subarea Concepts

Concept 2D – Highway 14/169 Interchange (Diverging Diamond)




CONCEPT EVALUATION

GOOD ++ FAIR + POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | ++ |
| Safety for all users | + |
| Community & environmental impacts | ++ |
| Fiscally responsible - $9M | ++ |
| Agency support | ++ |

SCORE 193.5

### Summary of Evaluation:

Goal A: Median areas provide opportunity for aesthetics/monumentation, but sightline concerns may limit this.

Goal B: Average side street delay is significantly reduced from the no build scenario.

Goal C: Increase in total number of crashes anticipated with adding traffic signals.

Goal D: Highway 14 West to Highway 169 ramp would impact the existing wetland and flood levee. Further coordination with FEMA will be required to understand the requirements associated with levee modifications or relocations.

Goal E showed minimal to no differentiating impact.

## Northern Subarea Local System Improvements

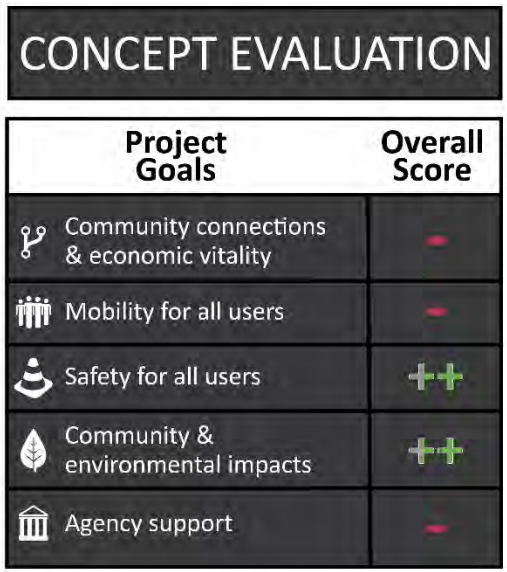
Concept L1 – Range Street Remains Open (No Change)

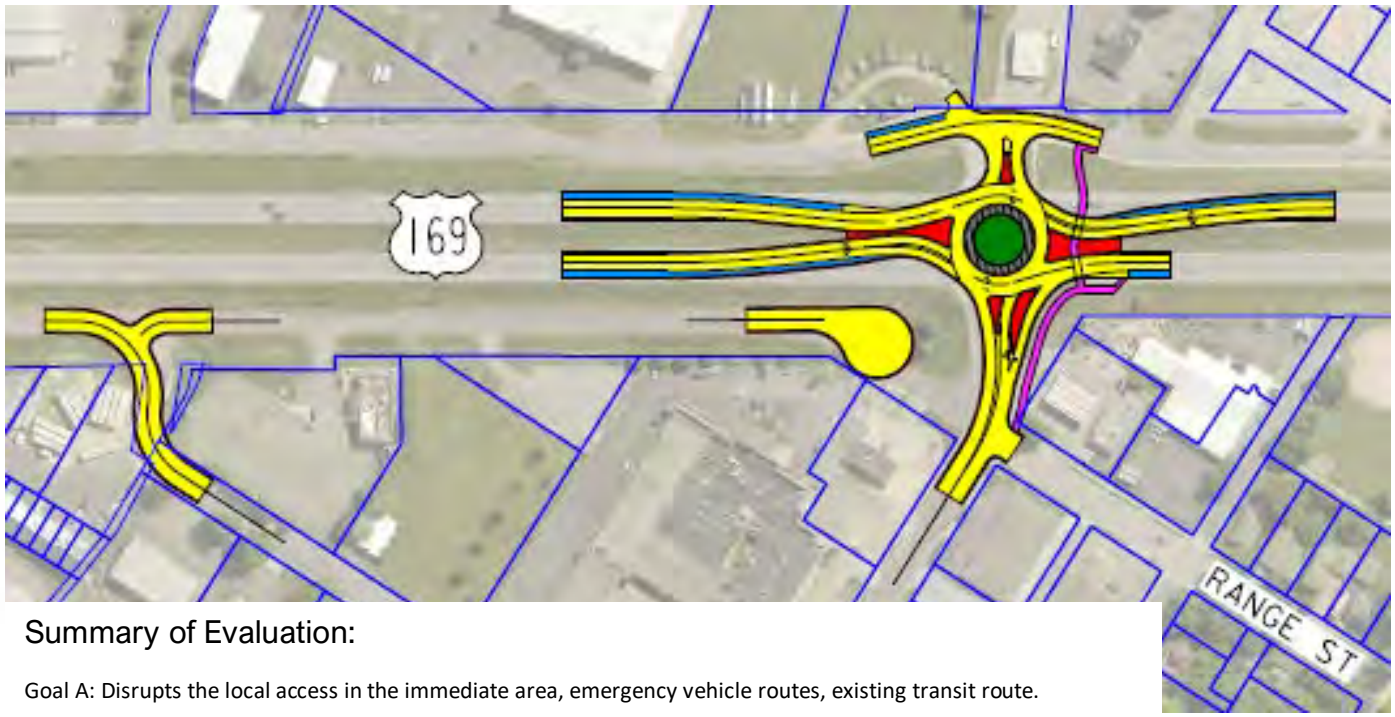
This concept would leave Range Street as it is today. The score is similar to Concept L4 on page 20. The main evaluation points include:

- Goal A: Maintains access for local trips and emergency routes (relative to Highway 169 improvement paired with).
- Goal C: Existing crash issues will continue (relative to Highway 169 improvement paired with).

## Northern Subarea Local System Improvements

Concept L2 – Range Street Cul-de-sac




SCORE -24

Summary of Evaluation:

Goal A: Disrupts the local access in the immediate area, emergency vehicle routes, existing transit route.

Goal C: Crash reduction anticipated with reduced access.

Goal B, D, and E showed minimal to no differentiating impact.



MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

**Northern Subarea Local System Improvements**

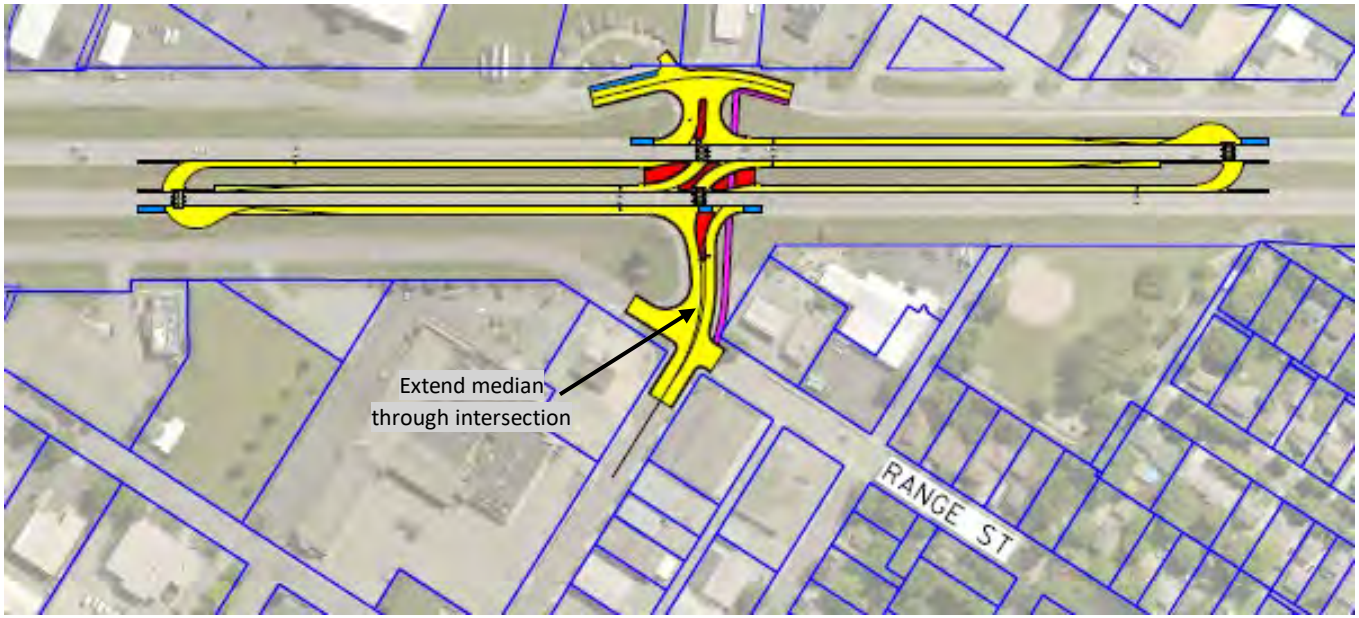
Concept L3 – Range Street Right-In/Right-Out

## CONCEPT EVALUATION

GOOD (++) FAIR (+) POOR (-)

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | + |
| Safety for all users | - |
| Community & environmental impacts | ++ |
| Agency support | ++ |

**SCORE 24**




### Summary of Evaluation:

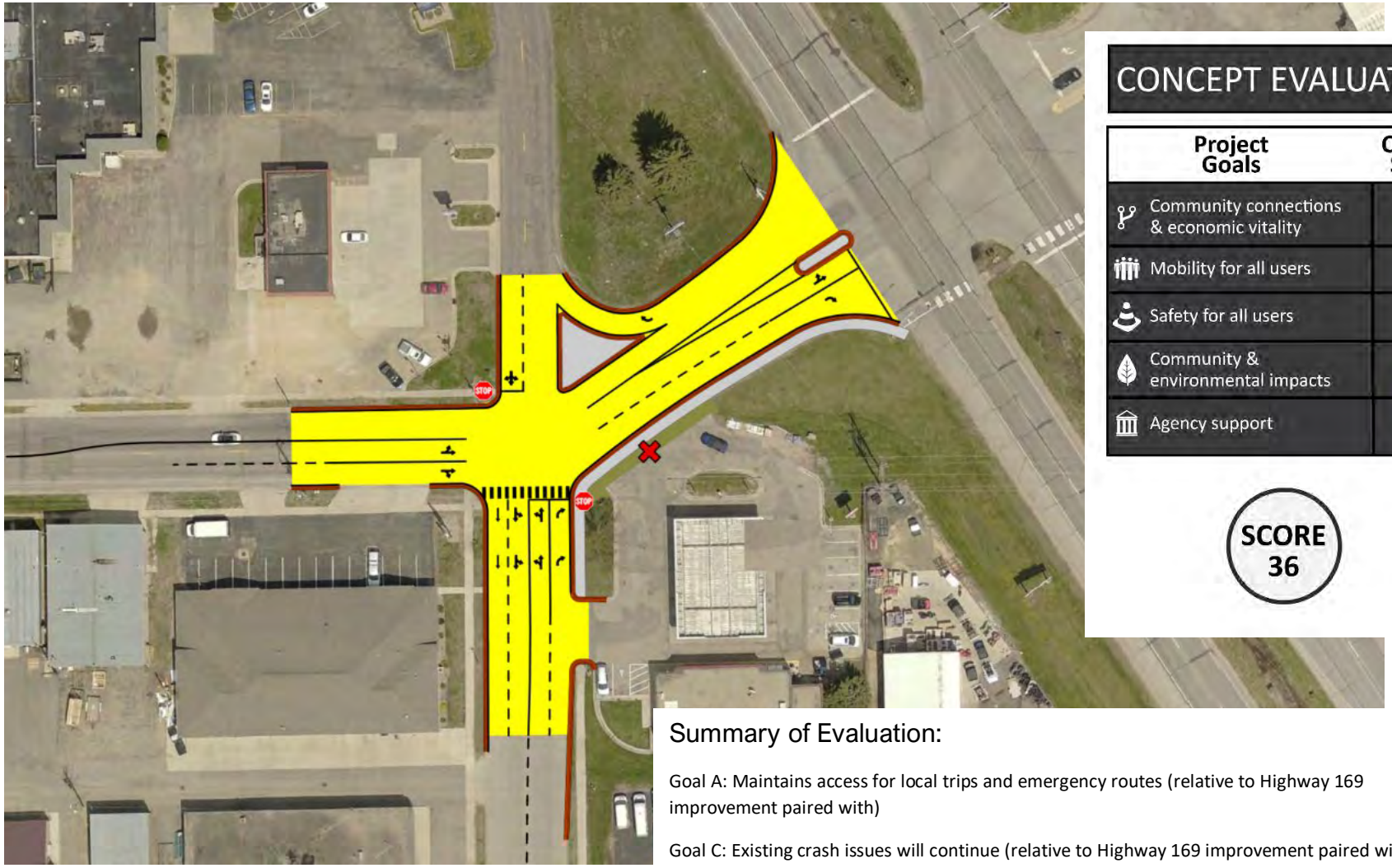
Goal A: Limits local access in the immediate area and emergency vehicle routes.

Goal C: Crash reduction anticipated with reduced access.

Goal B, D, and E showed minimal to no differentiating impact.

## Northern Subarea Local System Improvements

Concept L4 – Range Street Modernization




### Summary of Evaluation:

Goal A: Maintains access for local trips and emergency routes (relative to Highway 169 improvement paired with)

Goal C: Existing crash issues will continue (relative to Highway 169 improvement paired with)

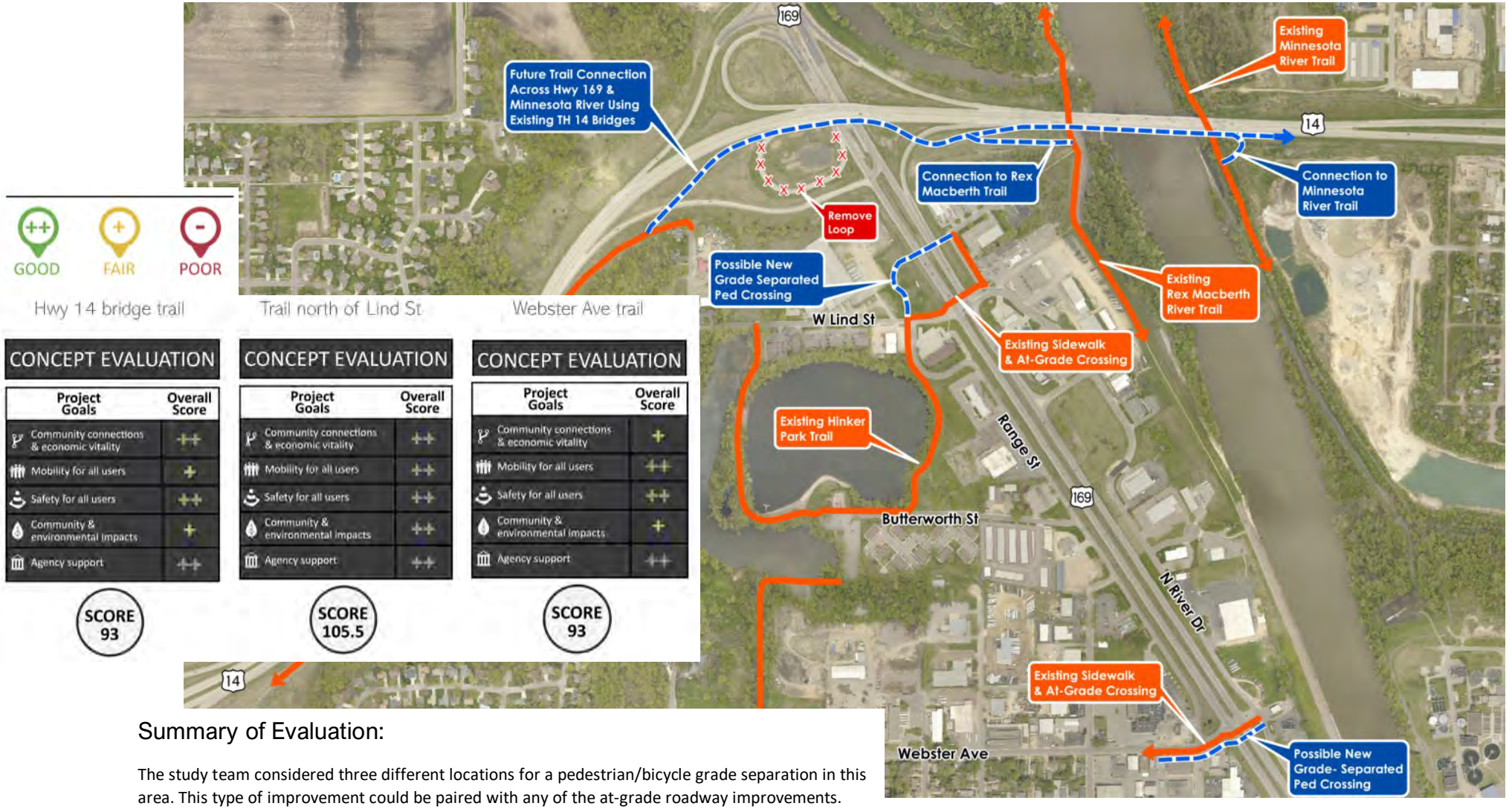
Goal B, D, and E showed minimal to no differentiating impact.



MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

## Northern Subarea Grade Separated Crossings




### Summary of Evaluation:

The study team considered three different locations for a pedestrian/bicycle grade separation in this area. This type of improvement could be paired with any of the at-grade roadway improvements. We considered a grade separation at Webster Avenue, Lind Street, and adjacent to Highway 14.

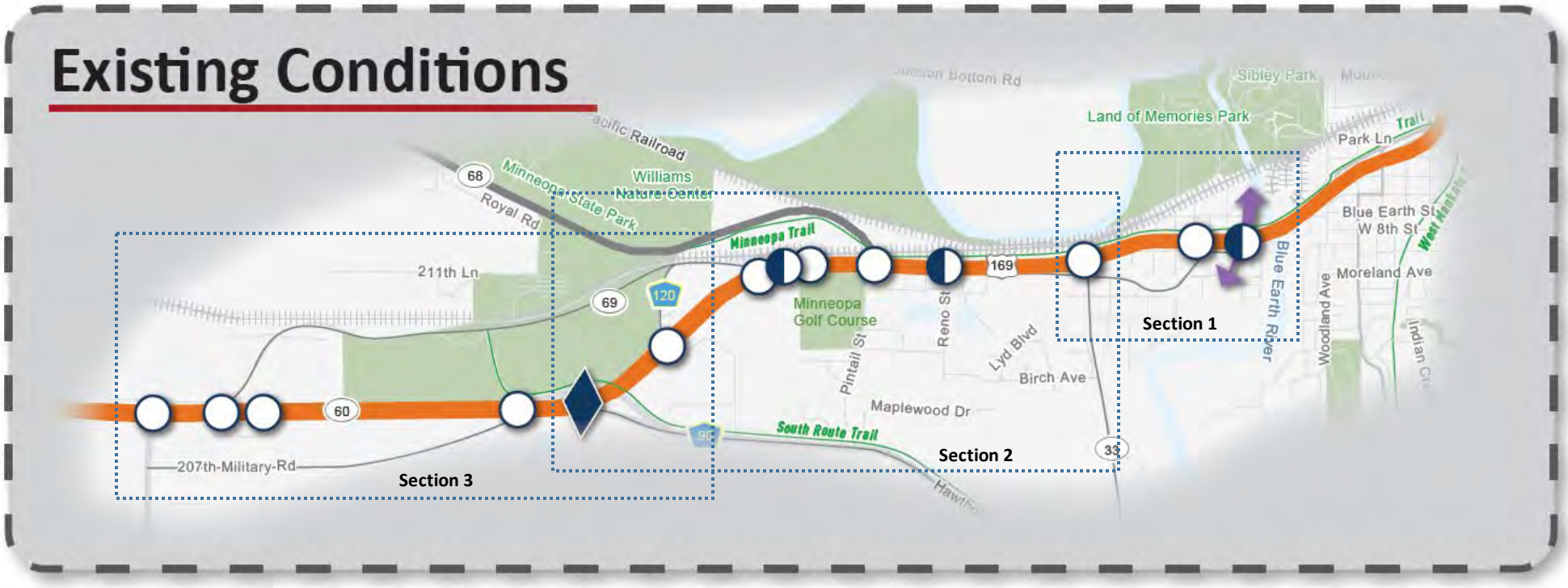
Both the Highway 14 bridge and Lind Street concepts scored the highest as they seemed to make the most natural connection between the Bluff Valley Trail and Rex MacBeth Trail for recreational users. These concepts also serve the pedestrian demand for access to convenience stores located east of Highway 169 and residential land uses west of Highway 169 near Lind Street.

# VI. Southern Subarea Evaluated Concepts

The following pages include images, description, and summary of scores for each concept. This also depicts how concepts were presented to the public. Full copies of the concept drawings can be seen on the MAPO website (www.mnmapo.org)

As shown in **Figure 4**, for ease in describing key corridor/network needs the subarea area was split into three sections based on the unique context within each. The study team looked at several lower cost/high benefit solutions to address the existing and anticipated future needs based on current area planning documents. The study team also explored and evaluated future scenarios that are opportunity driven if unplanned growth in the area occurs.

**Figure 4. Southern Subarea Existing Conditions and Sections**






MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

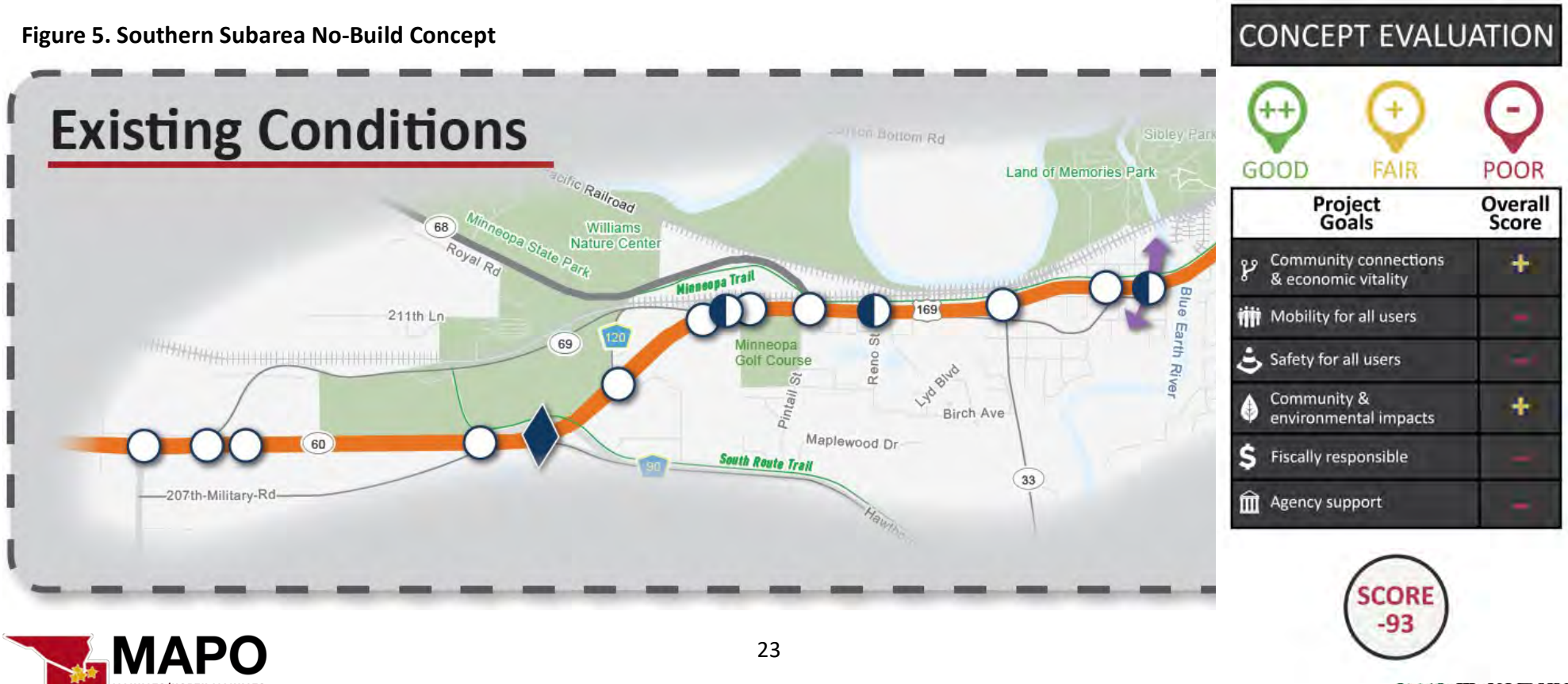
## Southern Subarea Concepts

### No-Build Concept

A southern subarea “no-build” concept was also evaluated against the study goals and given an overall score. The no-build concept is shown in **Figure 5**. The no-build scored very poorly with a negative score (-93 out of a possible 252 points) due to the many project goals it did not address. This justified to the study team that "doing nothing" is not a viable concept. The following is a high-level summary as to why. See the Traffic Operations Memo in **Appendix B** for more details.

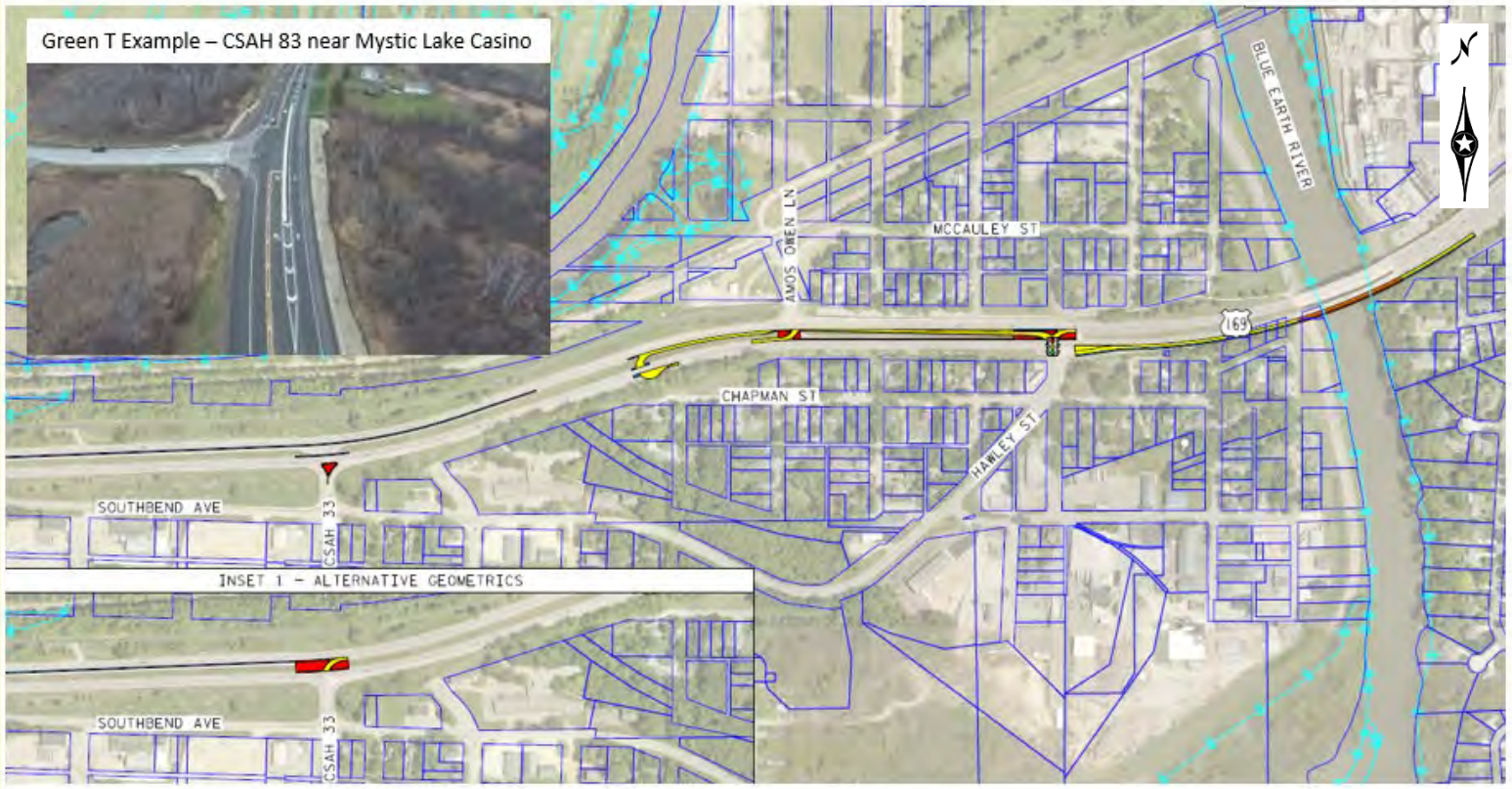
- 2040 traffic projections show back-ups particularly bad at WB left turn lane at Hwy 60, CSAH 69 (Hawley Street) and excessive delay at Highway 60 and CSAH 33 during the evening peak hours.
- Five of seven intersections are spaced closer than MnDOT access spacing guidelines allow
- There were a high number of crashes, 171 total with seven severe, between 2015 and 2019. Fatal crashes have occurred at CSAH 90, CSAH 69, Highway 68, and CSAH 69 (Hawley Street).
- There is a demand for pedestrian and bicycle access across Highway 169, at Hawley Street, to connect existing neighborhoods to a local convenience store.

**Figure 5. Southern Subarea No-Build Concept**



## Southern Subarea Concepts

Section 1: Concept 1C




CONCEPT EVALUATION

| | GOOD (++) | FAIR (+) | POOR (-) |
|---|---|---|---|
| Project Goals* | | | Overall Score |
| Community connections & economic vitality* | | | + |
| Mobility for all users* | | | ++ |
| Safety for all users | | | + |
| Community & environmental impacts | | | ++ |
| Fiscally responsible - $5.1M | | | ++ |
| Agency support | | | ++ |

*With Pedestrian Bridge

SCORE 67.5

### Summary of Evaluation:

Goal A: Limits CSAH 33 and Amos Owen Lane neighborhood access.

Goal B: Acceptable operations with all WBLs (Hawley Street and CSAH 33) at signalized Green T (Hawley Street). Does not address access spacing.

Goal C: Requires pedestrians to cross multiple lanes of traffic. Green-T would reduce severe crashes but increase rear end crashes with signal added along Highway 169.

Goal D: Low risk impact due to ability to construct improvements in existing right-of-way footprint.

Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.

## Southern Subarea Concepts

Section 1: Concept 1D



### Summary of Evaluation:

Goal A: Limits Hawley Street and Amos Owen Lane neighborhood access.

Goal B: Acceptable operations with all WBLs (Hawley Street and CSAH 33) at signalized Green T (CSAH 33). Does not address access spacing.

Goal C: Requires pedestrians to cross multiple lanes of traffic. Green-T would reduce severe crashes but increase rear end crashes with signal added along Highway 169.

Goal D: Low risk impact due to ability to construct improvements in existing right-of-way footprint.

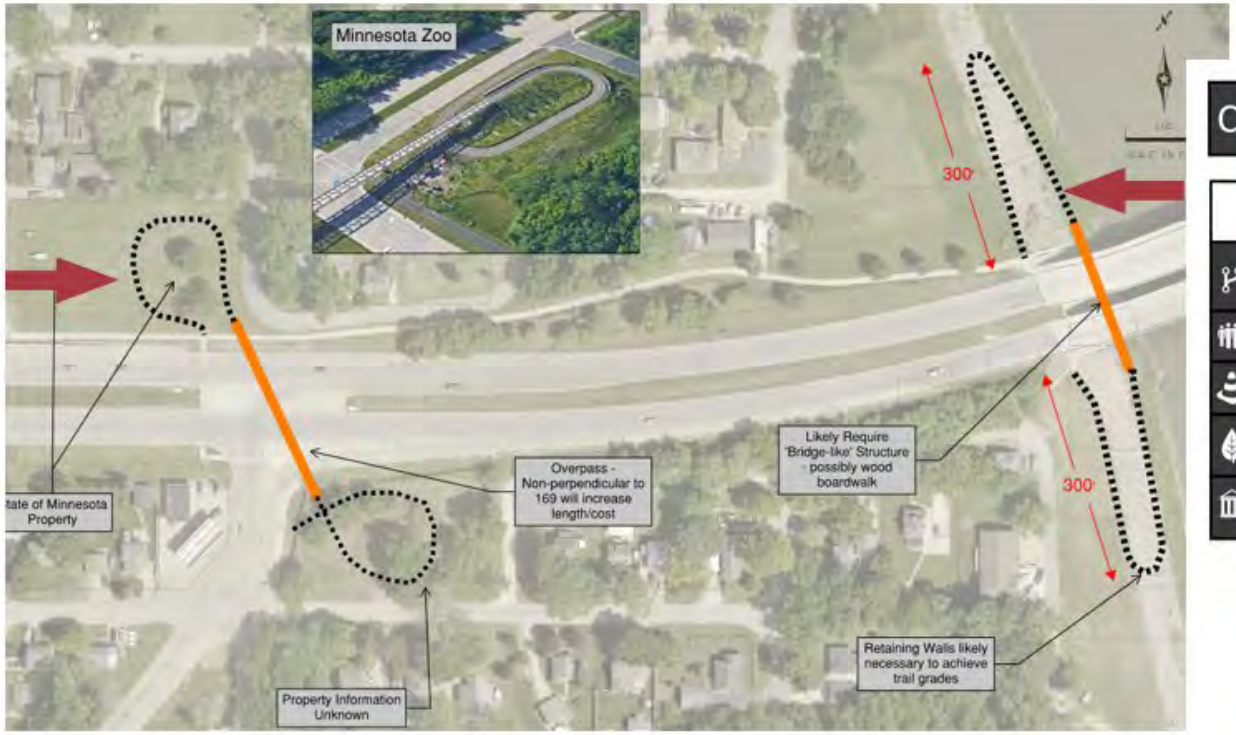
Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.

CONCEPT EVALUATION

GOOD ++ FAIR + POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | ++ |
| Agency support | ++ |

SCORE 102




CONCEPT EVALUATION

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | - |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | ++ |
| Agency support | + |

SCORE 78

## Summary of Evaluation:

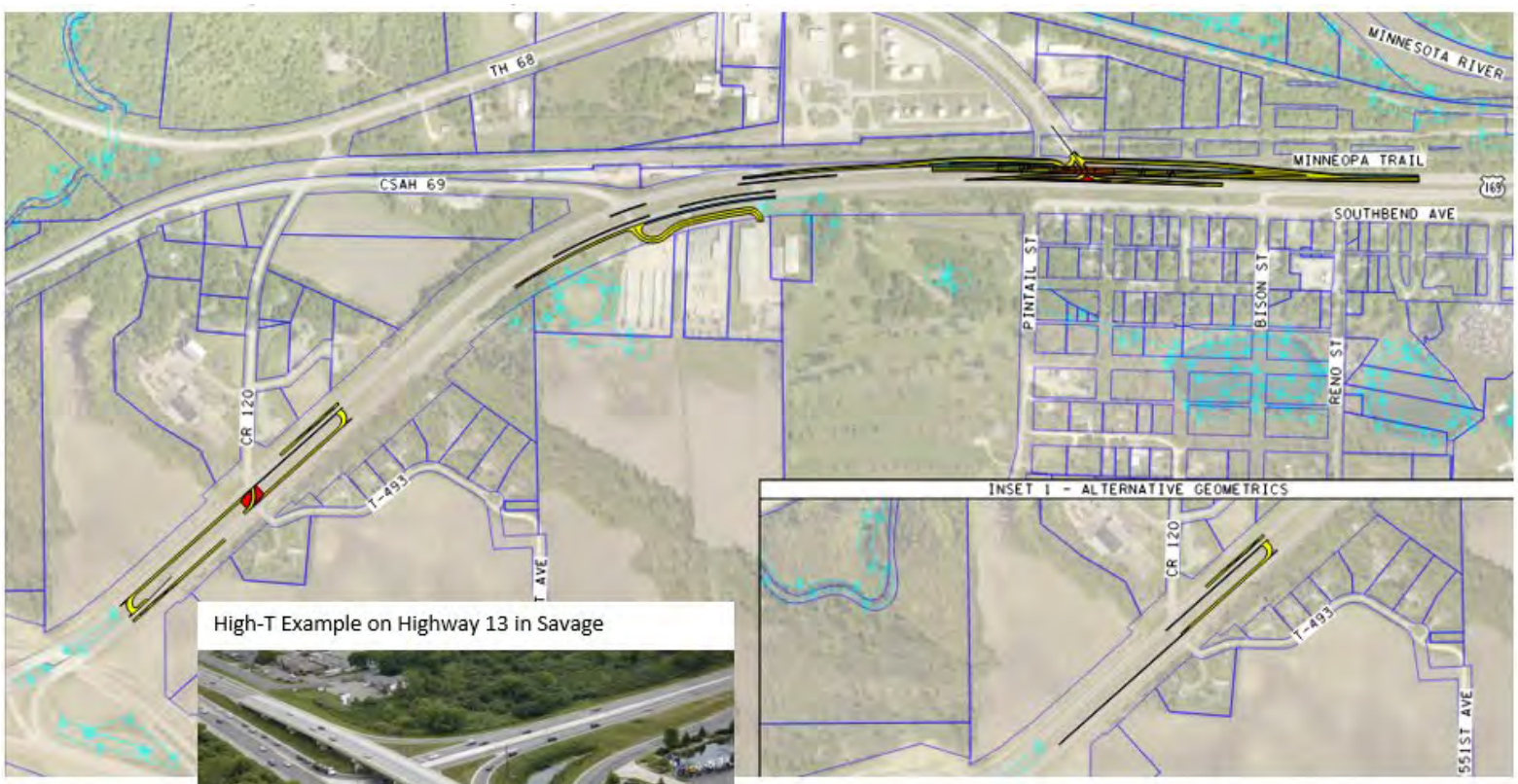
Goal A: The concept near Hawley Street would best serve existing demand for people to walk and bike across Highway 169 to and from the Quick Mart at the southwest quadrant of the intersection.

Goal D: The Hawley Street option would go over 169. This shows the footprint needed for the bridge and ramps that are accessible for all abilities. This is utilizing state owned land on the north and undeveloped section on the south.

Goal B, C and E showed minimal to no differentiating impact.

**Southern Subarea Concepts**

Section 2: Concept 2A




High-T Example on Highway 13 in Savage

## CONCEPT EVALUATION

GOOD ++ FAIR + POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | ++ |
| Fiscally responsible- 22.2M | + |
| Agency support | ++ |

SCORE 154.5

## Summary of Evaluation:

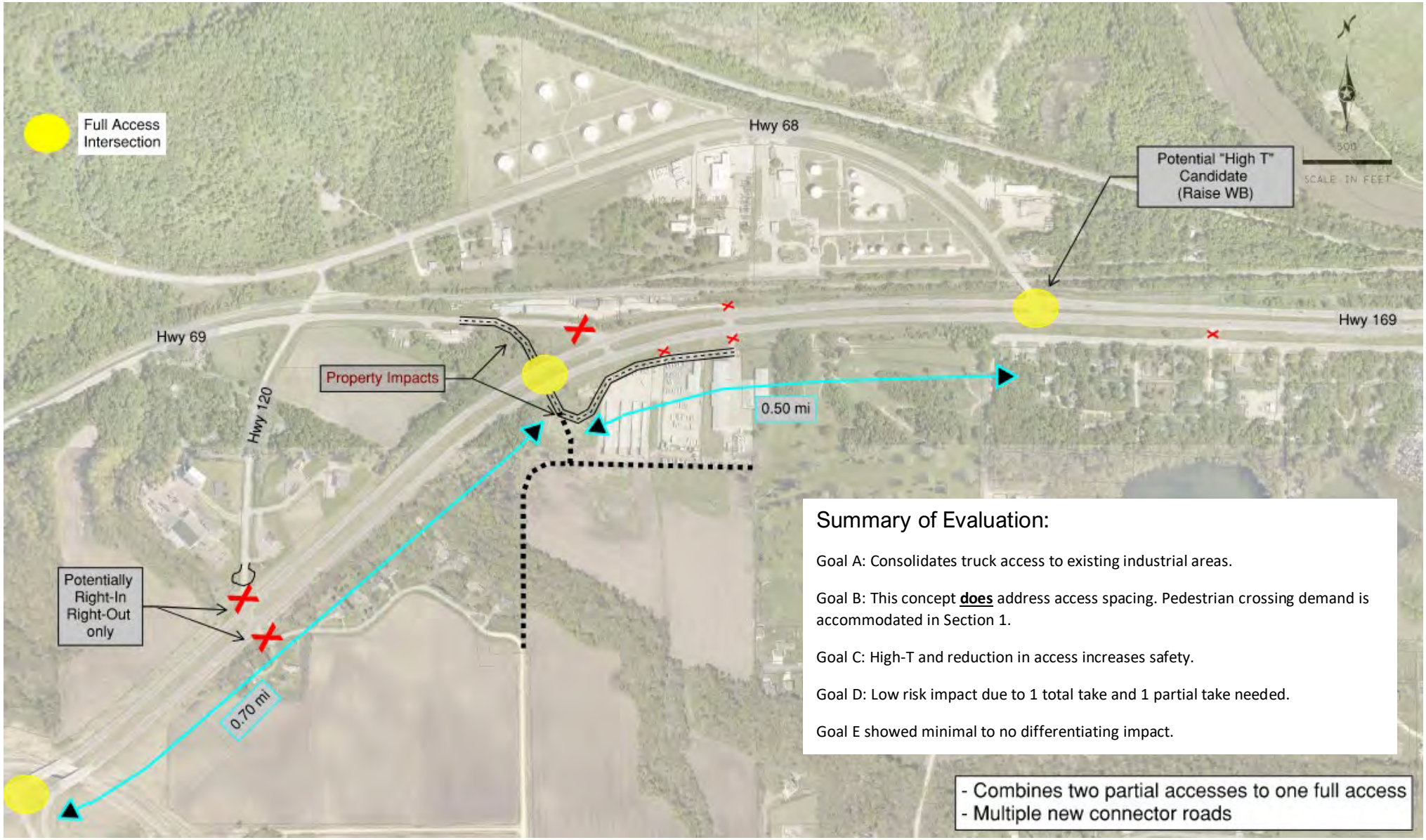
Goal A: Provides good local access.

Goal B: Does not meet access spacing guidelines. Pedestrian crossing demand is accommodated in Section 1.

Goal C: High-T and reduction in access increases safety.

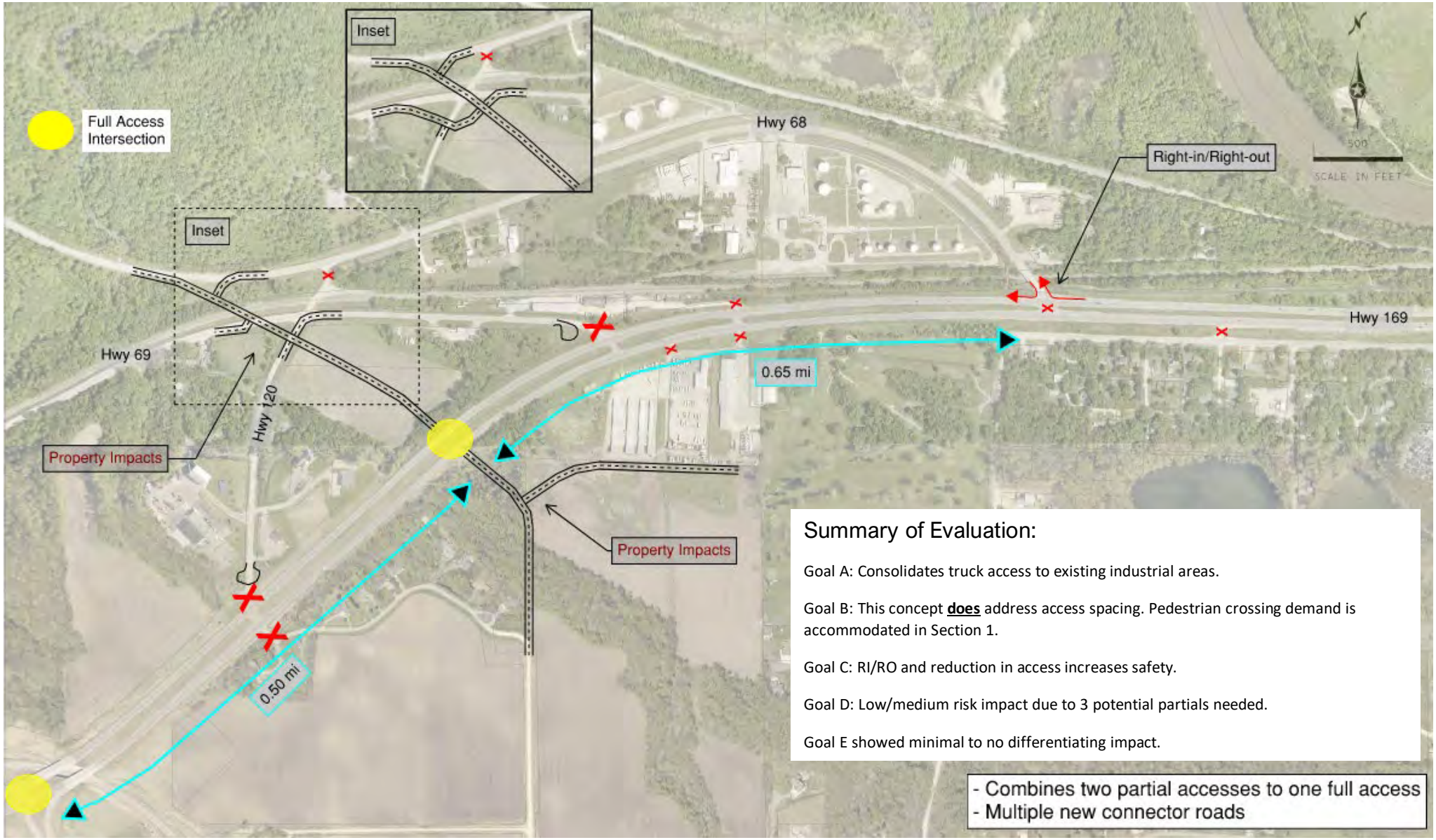
Goal D: Low risk impact due to 1 partial take needed south of CSAH 69.

Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.


Full Access Intersection
Hwy 68
Potential "High T" Candidate (Raise WB)
500
SCALE IN FEET
Hwy 69
Hwy 120
Property Impacts
Hwy 169
0.50 mi
Potentially Right-In Right-Out only
0.70 mi
Summary of Evaluation:
Goal A: Consolidates truck access to existing industrial areas.
Goal B: This concept does address access spacing. Pedestrian crossing demand is accommodated in Section 1.
Goal C: High-T and reduction in access increases safety.
Goal D: Low risk impact due to 1 total take and 1 partial take needed.
Goal E showed minimal to no differentiating impact.
- Combines two partial accesses to one full access
- Multiple new connector roads

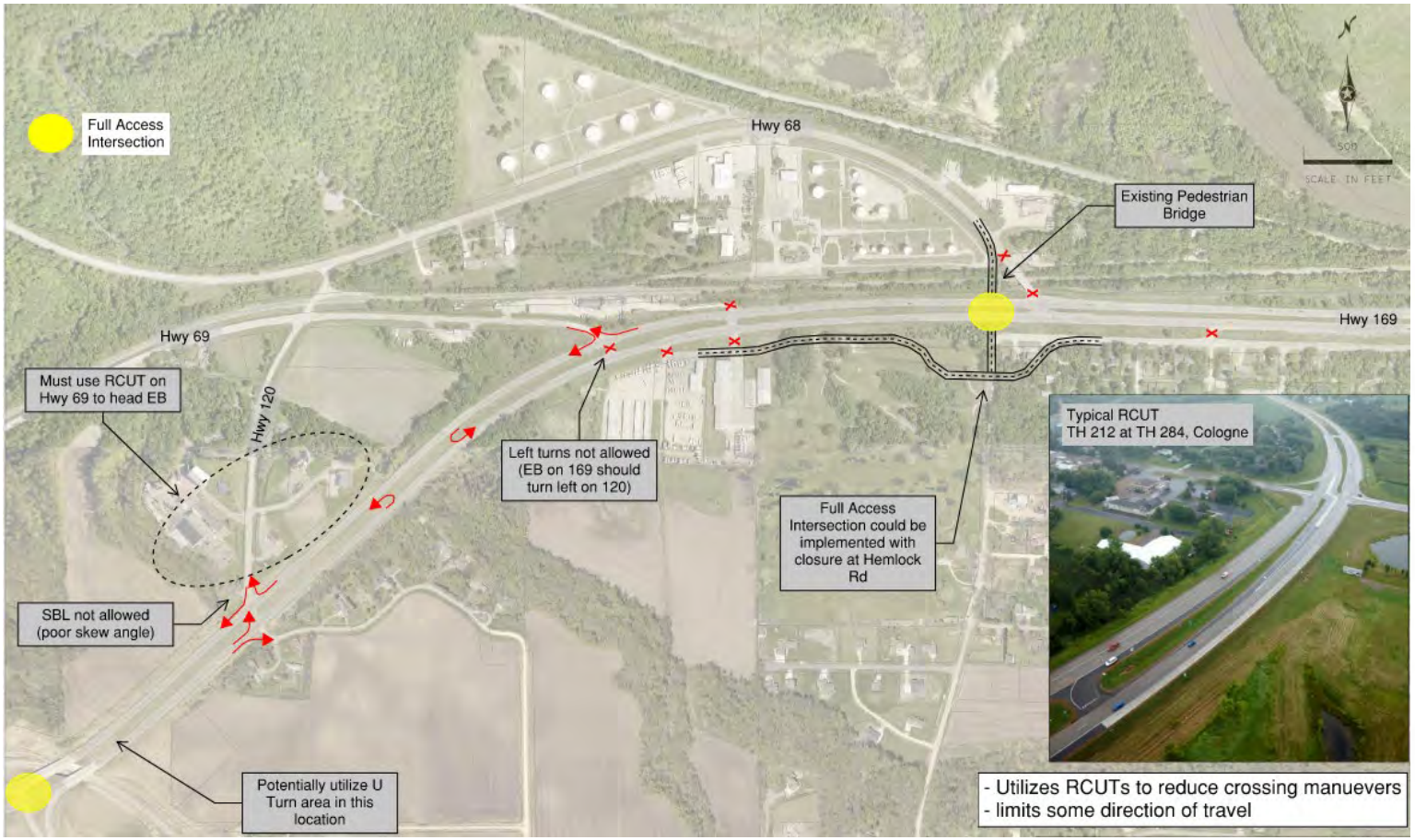
**Southern Subarea Concepts**

Section 2: Concept 2B2 (Opportunity/Development/Safety Driven)



**Southern Subarea Concepts**

Section 2: Concept 2C




## CONCEPT EVALUATION

GOOD ++ | FAIR + | POOR -

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | + |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | + |
| Fiscally responsible - $9M | + |
| Agency support | ++ |

SCORE 126

## Summary of Evaluation:

Goal A: RCUTs would increase travel time and result in consolidated truck access to existing industrial areas.

Goal B: Does not meet access spacing guidelines. Pedestrian crossing demand is accommodated in Section 1.

Goal C: RI/RO and reduction in access increases safety.

Goal D: Higher risk impact due to 3 total takes and 4 partial takes needed.

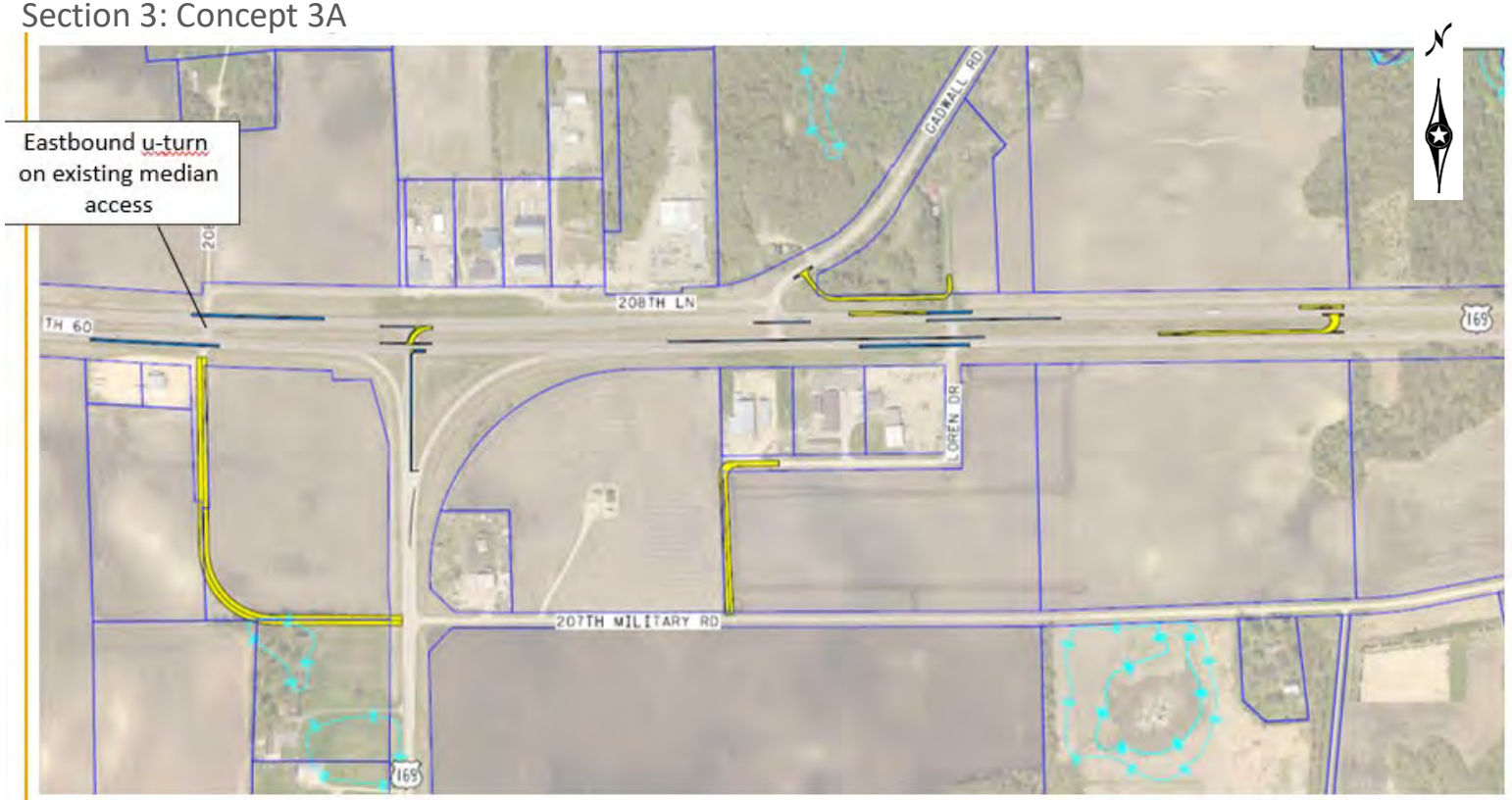
Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.

MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

## Southern Subarea Concepts

Section 3: Concept 3A




CONCEPT EVALUATION

GOOD FAIR POOR

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | + |
| Fiscally responsible - $1.9M | ++ |
| Agency support | ++ |

SCORE 157.5

### Summary of Evaluation:

Goal A: Good local access.

Goal B: Improves access spacing over existing conditions. Pedestrian access not a consideration in this section due to rural character.

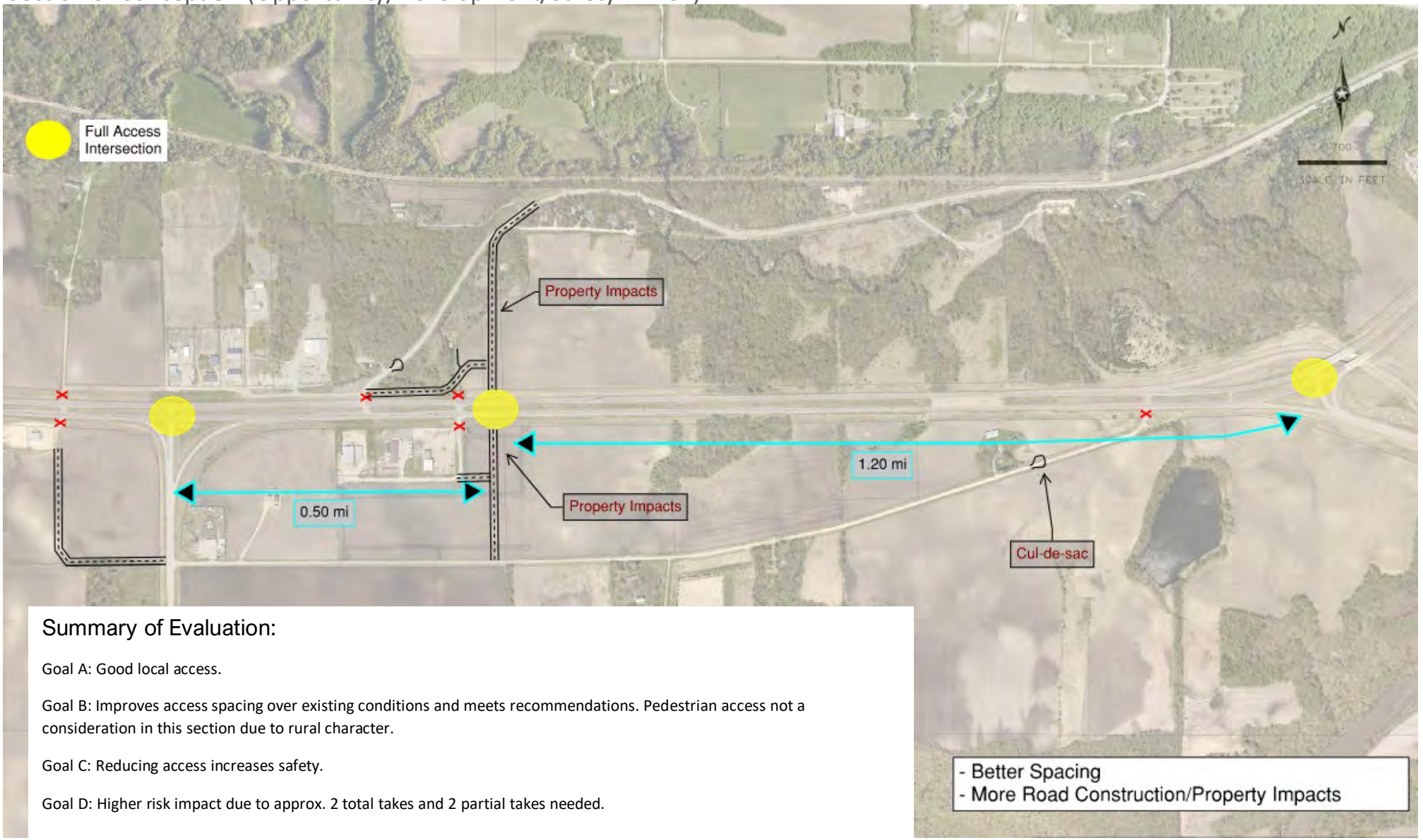
Goal C: Reducing access increases safety.

Goal D: Medium risk impact due to approx. 5 partial takes throughout the area.

Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.

## Southern Subarea Concepts

Section 3: Concept 3B (Opportunity/Development/Safety Driven)




### Summary of Evaluation:

Goal A: Good local access.

Goal B: Improves access spacing over existing conditions and meets recommendations. Pedestrian access not a consideration in this section due to rural character.

Goal C: Reducing access increases safety.

Goal D: Higher risk impact due to approx. 2 total takes and 2 partial takes needed.

# VII. Concept Updates

The following concept updates were made based on feedback at and following the July 2021 focus group meetings and public open house.

### Northern Subarea

Concept 2C – Highway 14/169 Interchange (Eastbound Ramp Signal)

After further evaluation, Concept 2C was updated since a crash issue does not currently exist at the loop ramps. This update retains the southbound to eastbound loop ramp which keeps this a free-flowing movement and reduces the number of phases needed at the signalized intersection.


SCORE 183

Summary of Evaluation:

Goal B: Average side street delay is significantly reduced from the no build scenario.

Goal C: Increase in total number of crashes anticipated with adding traffic signal.

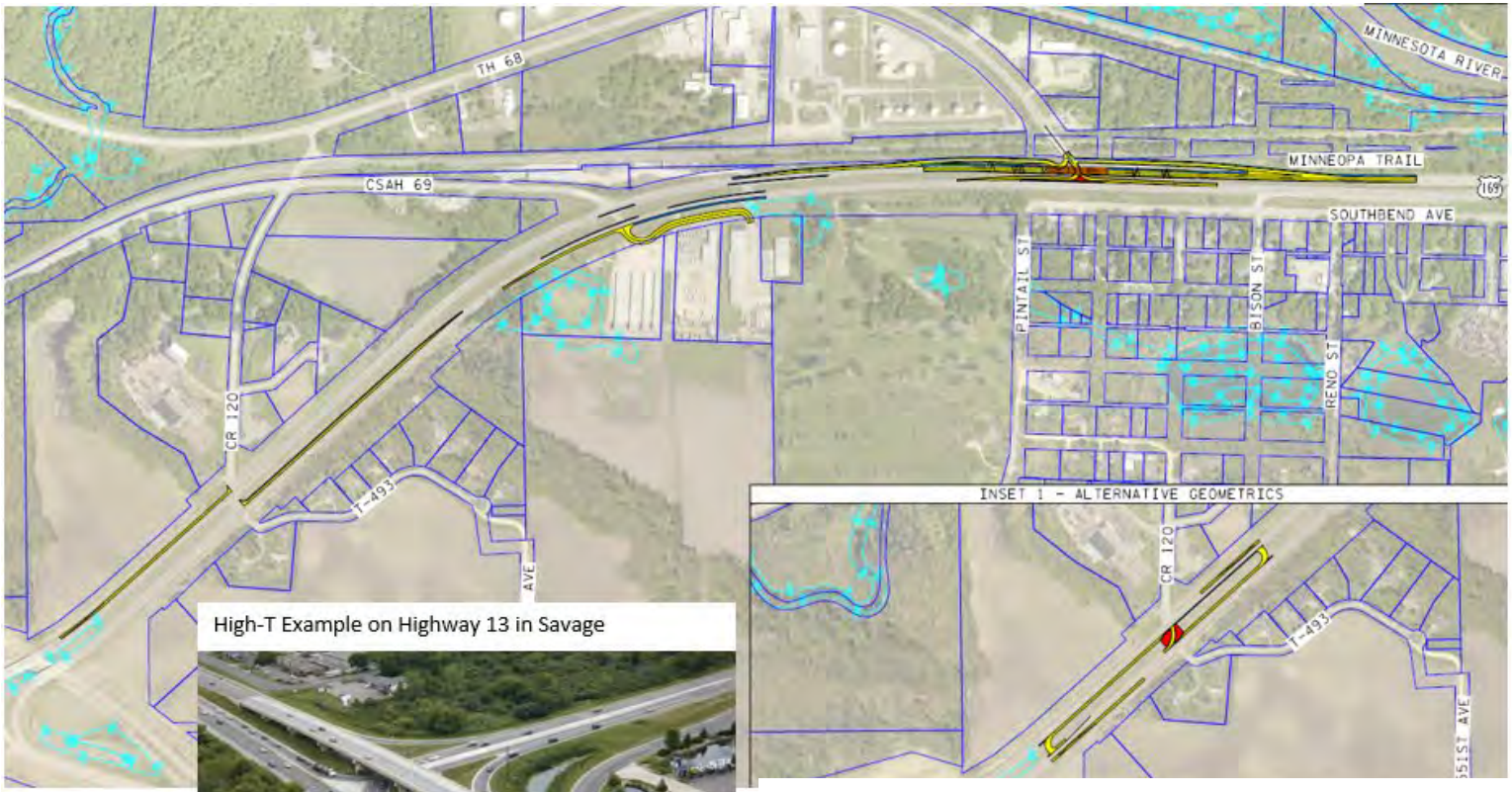
Goal D: Alone poses low risk and further evaluation needed relative to what it is paired with for improvements to the south.

Goal A and E showed minimal to no differentiating impact.

## Southern Subarea

Concept 2A

This concept update addresses concerns the project team heard from the owner of Benco Electric Cooperative, a business located in the northeast quadrant of the County Road 120 and Highway 169 intersection, at the June 2021 focus group meetings. The Benco owner shared that their large trucks often struggle with movements on and off Highway 169 related to acceleration and deceleration necessary for merging into high-speed highway traffic. The Benco owner also shared that acceleration and deacceleration areas would also help with safety concerns of all their employees traveling to and from work around the same time.




High-T Example on Highway 13 in Savage

CONCEPT EVALUATION

| GOOD (++) | FAIR (+) | POOR (-) |
|---|---|---|

| Project Goals | Overall Score |
|---|---|
| Community connections & economic vitality | ++ |
| Mobility for all users | ++ |
| Safety for all users | ++ |
| Community & environmental impacts | ++ |
| Fiscally responsible- 22.2M | + |
| Agency support | ++ |

SCORE 154.5

### Summary of Evaluation:

Goal A: Provides good local access.

Goal B: Does not meet access spacing guidelines. Pedestrian crossing demand is accommodated in Section 1.

Goal C: High-T and reduction in access increases safety.

Goal D: Low risk impact due to 1 partial take needed south of CSAH 69.

Goal E: The cost estimate does not cover all partial property impacts or any easements necessary.



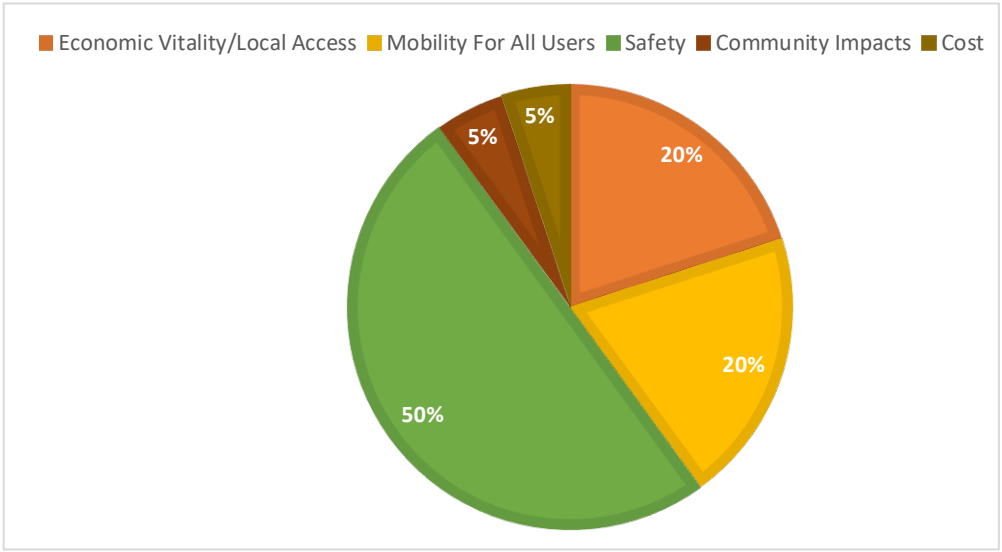
MAPO MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK Real People. Real Solutions.

# VIII. Final Concept Scoring

A score was determined for each concept to measure its overall benefit and how it compared to others. Each goal was broken down into objectives. The objectives vary by subarea and are shown in **Appendix A**. As shown on the matrices, concepts that did not meet the objective or presented a high risk was given -6 points, a minimally met objective or medium risk was given 3 points and met objective or low risk was given 9 points. The PMT then weighted the importance of each goal. Based on the goal weights shown in **Figure 6**, concept scoring relative to each goal was multiplied by its assigned weight.

**Figure 6. Study Goal Weighting Breakdown**




Based on the scores received for each concept, the study team conducted a planning-level Benefit Cost Analysis and graphed the results for the Northern and Southern Subareas. The Benefit Cost Analysis assumed infrastructure costs in 2022 dollars. The planning level costs including 20% contingency and 20% for design and construction engineering fees. Right of way costs were not included in the planning level benefit cost analysis shown below. See **Figures 7 – 11** on the following pages.

**Figure 7. Northern Subarea Expressway Benefit Cost Analysis**

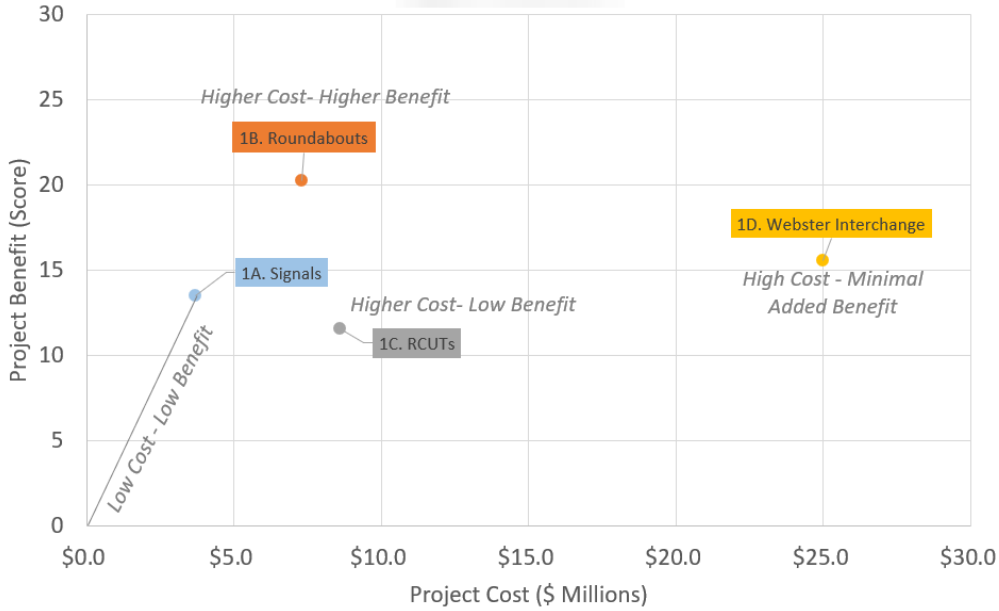


**Figure 7** shows the benefit cost analysis for the concepts at Lind Street, River Lane and Webster Avenue in the Northern Subarea. This indicates that Concept 1B (Roundabouts) offers a high benefit, but at a higher cost than the Concept 1A (Signals). Concept 1A (Signals) and Concept 1C (RCUTs) have lower costs, but also offer a lower overall benefit. Concept 1D (Webster Interchange) has a much higher cost minimal added benefit compared to Concepts 1A and 1C.

**Figure 8. Northern Subarea (Highway 14 Interchange) Benefit Cost Analysis**

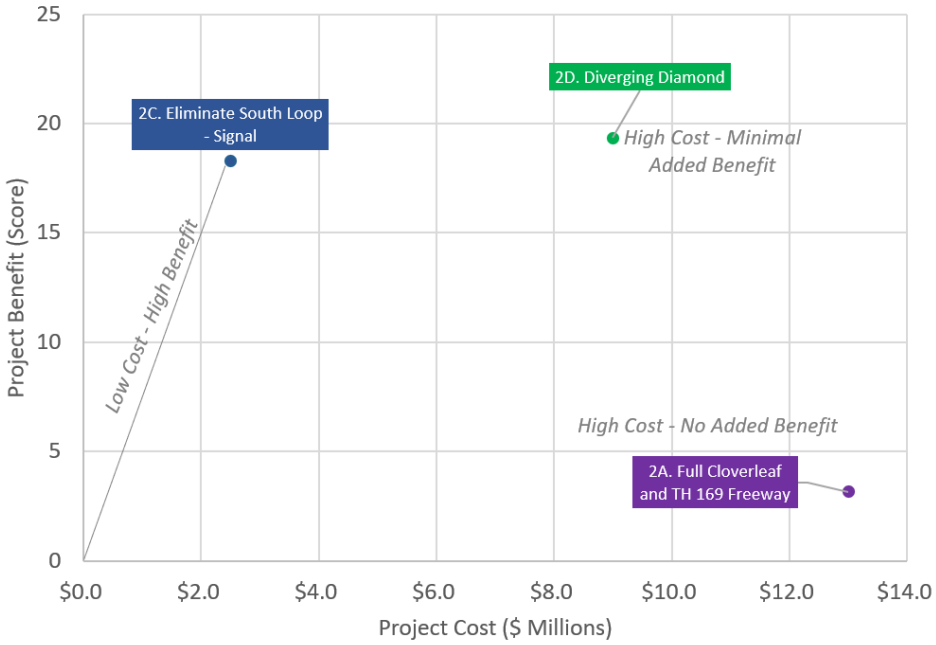



**Figure 8** shows the benefit cost analysis for the Highway 14 interchange concepts in the Northern Subarea. This shows that Concept 2C (Eliminate South Loop - Signal) provides the best cost to benefit ratio. This concept has a high benefit at a low cost. Concept 2D (Diverging Diamond) has a higher cost but offers minimal additional benefit. Concept 2A (Full Cloverleaf and TH 169 Freeway) has a much higher cost but offers minimal benefit.

**Figure 9. Southern Subarea – Section 1 Benefit Cost Analysis**

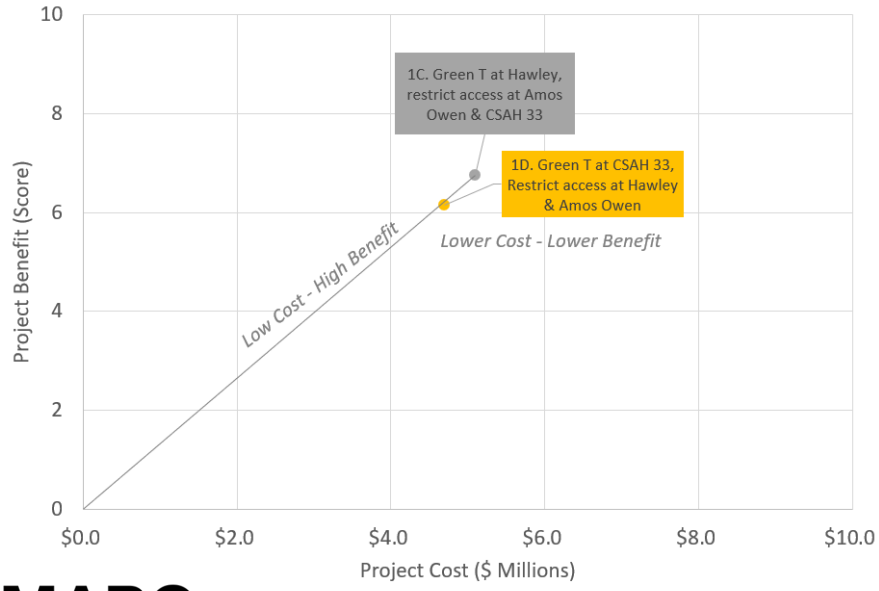


**Figure 9** shows the benefit cost analysis for the Section 1 concepts in the Southern Subarea. The shows that Concept 1C (Green T at Hawley Street) provides the best cost to benefit ratio. This concept has the highest benefit at a lower cost. Concept 1D (Green T at CSAH 33) has a lower cost, but also offers a lower overall benefit.

**Figure 10. Southern Subarea – Section 2 Benefit Cost Analysis**

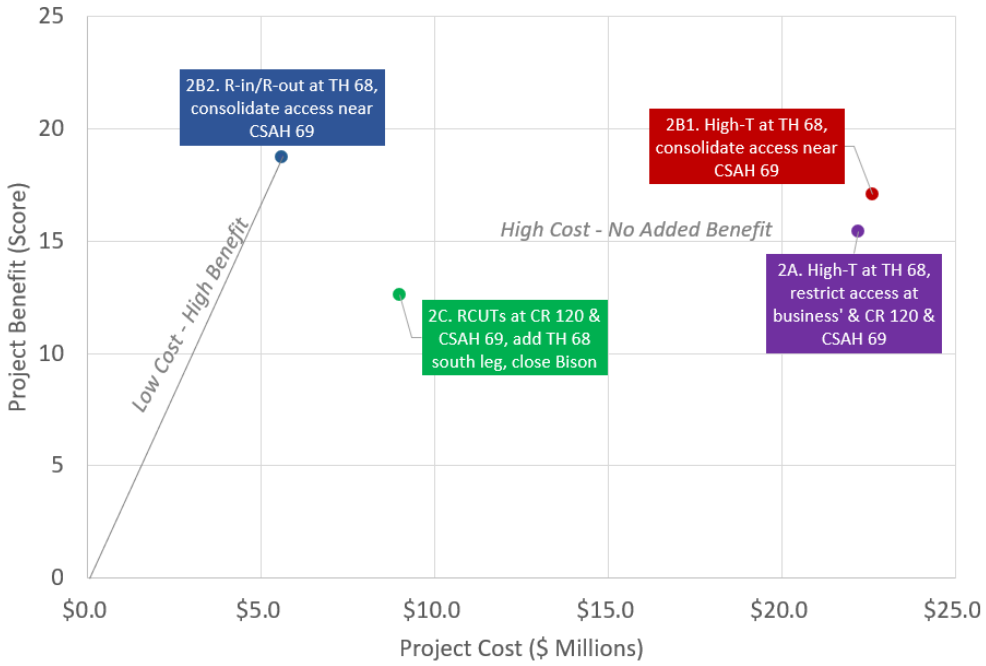



**Figure 10** shows the benefit cost analysis for the Section 2 concepts in the Southern Subarea. The shows that Concept 2B2 provides the best cost to benefit ratio. This concept has the highest benefit and the lowest cost. Concepts 2A, 2B1, and 2C all have higher costs and offer a lower benefit.

**Figure 11. Southern Subarea – Section 3 Benefit Cost Analysis**

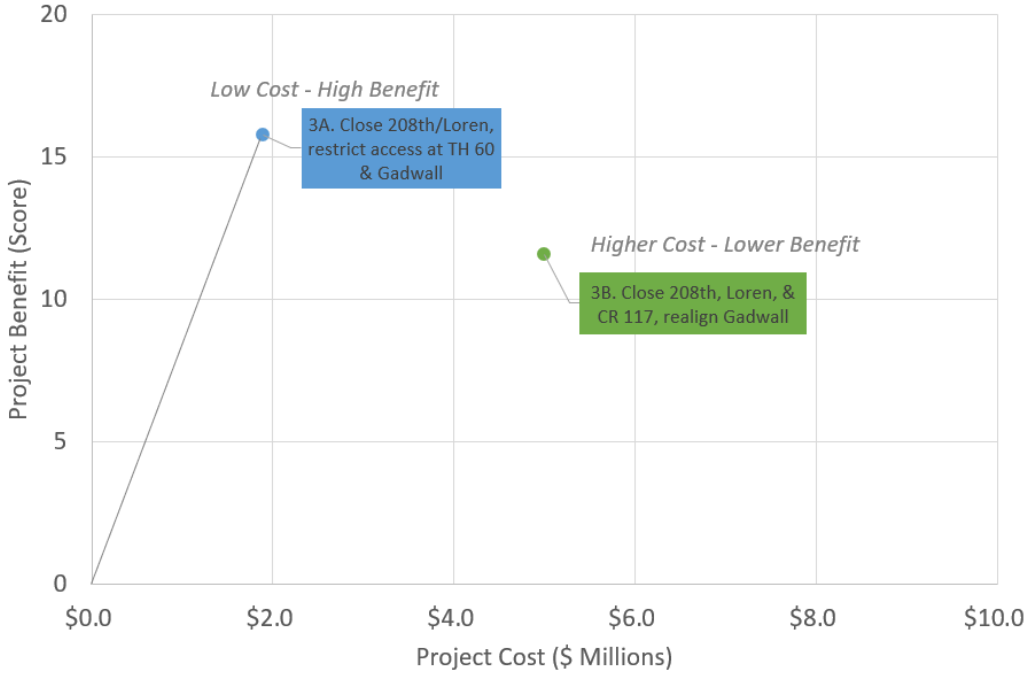


**Figure 11** shows the benefit cost analysis for the Section 3 concepts in the Southern Subarea. The figure indicates that Concept 3A is the concept with the optimal cost to benefit ratio. This concept has the highest benefit at the lowest cost. Concept 3B has a higher cost and offers a lower benefit.

# IX. Detailed Benefit Cost Analysis

A detailed benefit cost analysis was completed for the Northern Subarea concepts. The results of the benefit cost analysis are summarized below. For more information see the full documentation of the benefit cost analysis process in **Appendix F**. Safety and delay benefits were analyzed over a 20-year project lifespan and compared to the overall project cost to determine which concepts are anticipated to have a greater benefit than cost and which have benefits that do not offset the cost. The results of the benefit cost analysis are summarized in **Table 4** below for the Lind/River/Webster concepts and **Table 5** for the TH 14 Concepts. The total cost listed includes right of way acquisition for full take properties. Only concepts 1d and 2a were assumed to have full property takes based on the planning level concepts. The cost of acquiring the properties was assumed to be three times the current market value of the property. For concept 1d, six of the properties adjacent to the existing TH 169 and Webster Ave intersection were assumed to be acquired. For concept 2a, only one property was assumed to be acquired.

**Table 4. Benefit-Cost for Lind/River/Webster Concepts**

| Concepts | Safety Benefit | Delay Benefit | Total Cost | B/C Ratio |
|---|---|---|---|---|
| Concept 1a. Signalized Expressway | $ - | $ (9,762,231) | $ 3,700,000 | **-2.64** |
| Concept 1b. Roundabout Expressway | $ 386,419 | $ 19,284,962 | $ 7,300,000 | **2.69** |
| Concept 1c. RCUT Expressway | $ 7,798,000 | $ (16,013,057) | $ 8,600,000 | **-0.96** |
| Concept 1d. Interchange at Webster | $ 14,711,915 | $ 74,206,498 | $ 29,431,000 | **3.02** |

**Table 4** indicates that concepts 1b and 1d both have anticipated benefits that are higher than project costs. Since concepts 1a and 1c have benefit cost ratios less than one, the anticipated benefits do not offset the cost. Delay benefits for the concepts 1a and 1c were found to be negative as delay is increased overall with these options.

**Table 5. Benefit-Cost for TH 14 Concepts**

| Concepts | Safety Benefit | Delay Benefit | Total Cost | B/C Ratio |
|---|---|---|---|---|
| Concept 2a. Full Cloverleaf Interchange (lower end) | $ 2,458,951 | $ 91,765,194 | $ 17,079,000 | **5.52** |
| Concept 2a. Full Cloverleaf Interchange (higher end) | $ 2,458,951 | $ 91,765,194 | $ 26,079,000 | **3.61** |
| Concept 2c. Eliminate South Loop - Signal | $ (11,782,418) | $ 52,640,901 | $ 2,500,000 | **16.34** |
| Concept 2d. Diverging Diamond | $ (3,886,305) | $ 49,628,565 | $ 9,000,000 | **5.08** |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ (1,279,631) | $ 82,151,540 | $ 500,000 | **161.74** |

**Table 5** indicates that all of the TH 14 concepts have anticipated benefits that are higher than the project costs. Safety benefits for the concepts 2c, 2d, and 2f were found to be negative as crashes are

anticipated to increase with these options. Concept 2f shows the highest benefit cost ratio as this concept offers a significant delay benefit at a low cost.

It should be noted for the freeway design (Concepts 1d and 2a), the full cost of these projects is likely underrepresented. The total right-of-way and relocation costs are difficult to predict at a planning-level without detailed designs. As noted above, only full property acquisitions are currently included in the cost calculation. Relocation costs are not included. In addition, both cities have identified additional potential costs due to business closures and reductions in tax base. These costs are also not factored in at this point. Because of these additional influences, it should be anticipated that the total project cost for these concepts will go up and the Benefit/Cost Ratios for each will be reduced.

# X. Implementation Plan

The implementation plan is depicted in tables for the Northern and Southern Subareas in Appendix G. The separate subarea tables prioritize standalone projects to be strategically and incrementally implemented over the next fifteen or more years. Timing of projects is organized into short-term (0-5 years), mid-term (6-15 years), or projects that are opportunity driven or only necessary with increased development or rise in safety issues. The mid-term projects are meant to align with MnDOT's planned investments for 2027, particularly in the Northern Subarea. The overall implementation timeframes also coincide with the MAPO Long-Range Transportation Plan (LRTP) implementation timeframes for short-term (2021-2025) and Mid-Term 1 (2026-2030). The Highway 169 Corridor Study implementation plan does not have any projects that would align with the LRTP's Mid-Term 2 (2031-2035) or Long-Term (2036-2045). All remaining Highway 169 recommendations are shown in the Opportunity/Development/Safety Driven implementation category.

The detailed benefit cost analysis for the Northern Subarea determined that a freeway (full cloverleaf Concept 2D) is not needed for operations projected out to 2040. The signalized exit ramp (Concept 2f) showed comparable delay benefits at significantly less cost. The roundabout express way (Concept 1B) showed comparable benefits with significantly less cost to the Webster Avenue interchange (Concept 1D) out to 2040. The roundabout express way (Concept 1B) is also a concept supported by local agencies and the public including the freight generating businesses.

In summary, the freeway concepts are not included in the vision and implementation plan because of the lower-cost/high-benefit alternate solutions that are recommended.

# XI. Next Steps

Additional design, studies and public input will be needed for each of the recommended improvement concepts to move forward. The purpose of the Highway 169 Corridor Study was to develop a long-term plan for improvements. The concepts developed as part of this study are high-level and will need additional refinement through preliminary and final design. Environmental review and permitting will also be required with exact requirements based on the scope of the project and the funding source. See **Appendix D** for environmental screening considerations and considerations for concept scores. Also see the Existing Conditions Report for more detail on the study environmental review.

The improvement concepts identified within this study and the projects prioritized as part of the implementation plan will help the Mankato Area Planning Organization (MAPO), MnDOT and the Cities of Mankato, North Mankato, Blue Earth County, and Nicollet County to continue to maintain a functioning yet safe principal arterial roadway.

Study partners must continue to work together to further plan, obtain funding, design, and implement the recommended improvement projects. All partners have an active role in implementing these improvements. All competitive funding sources should be considered. Agencies should also update their comprehensive and transportation plans to include these findings to better leverage funding sources.

# Evaluation Memo Appendix A

SUBAREA EVALUATION MATRICES

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

# Highway 169 Evaluation

## Northern Subarea Concept Evaluation Summary

Does Not Meet Measure/ High Risk: -6 pts | Minimally Meets Measure/ Medium Risk: 3 pts | Meets Measure/ Low Risk: 6 pts

| Goals | Objectives | No Build | Highway 169 Concepts | | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1a | 1b | 1c | 1d | 2a | 2b | 2c | 2d | 2e | |
| | | | Signalized Expressway | RAB Expressway | RCUT Expressway | Freeway | Freeway | Spot Interchange - Expressway | | | | |
| | | | Combined River Ln / Lind St and Webster Ave Remain Signalized | Combined River Ln / Lind St RA and Webster Ave Roundabouts | Combined River Ln / Lind St RCUT and Webster Ave RCUTs | Webster Ave Interchange | TH 14 Interchange Full Cloverleaf and TH 169 Freeway | TH 14 Interchange Eliminate South Loop - Roundabout | TH 14 Interchange Eliminate South Loop - Signal | TH 14 Interchange Diverging Diamond | TH 14 Interchange RA Ramp Intersections | |
| GOAL A: Preserve community connections and economic vitality. | Maintain sustainable access for local trips into/out of Mankato and North Mankato. | Baseline | | | | | | | | | | Quantitative - travel time and network efficiency<br>2a Freeway will result in increased travel time from TH 14 to area around McDonalds and Lind Street |
| | Maintain emergency access routes into/out of Mankato and North Mankato. | Baseline | | | | | | | | | | Qualitative - design, system connectivity, traffic calming impacts to response times |
| | Accommodate reasonable vehicle/truck access | | | | | | | | | | | Qualitative - Agency and public perception |
| | Accommodate reasonable ped/bike access | | | | | | NA | NA | NA | NA | NA | Qualitative - Agency and public perception |
| | Enhance community identity. | | | | | | | | | | | Qualitative - median areas provide opportunity for aesthetics/monumentation.<br>Traffic signals do not include median areas along side street approaches.<br>Large cloverleaf footprint provides limited opportunities for aesthetic improvements.<br>Sightline concerns with RCUT medians. |
| GOAL B: Provide efficient and reliable mobility for all users. | Provide acceptable system reliability serving existing and planned growth. | | | | | | | | | | | Quantitative - serves existing and forecasted ADT<br>2b does not improve problematic operations at the EB TH 14 exit ramp<br>2e causes excessive delay and queuing for WB TH 14 to SB TH 169 movement |
| | Provide acceptable regional highway travel times while accommodating reliable local access. | Baseline | | | | Did not model this option | Did not model this option | | | | | Quantitative - average through trip travel time<br>Green - adds <60 seconds<br>Yellow - adds 60-120 seconds<br>Red - adds 120+ seconds |
| | Provide acceptable side street delay | EBL/R (TH 14) operates with LOS F | Several movements operate with LOS E | EBL/T (Webster) and EBL/T (Lind/River) operate with LOS F | Several movements operate with LOS E | Did not model this option | Did not model this option | EBL/R (EB TH 14 Exit Ramp) operate with LOS F | EBL & SBL (EB TH 14 Exit Ramp) operate with LOS E | | WBL/R & SBR (WB TH 14 Exit Ramp) and EBL/R (EB TH 14 Exit Ramp) operate with LOS F | Quantitative - side street LOS<br>Green: All side street movements operate with LOS A - D<br>Yellow: Side street movements operate with LOS E<br>Red: Side street movements operate with LOS F |
| | Improves side street delay over existing conditions | Baseline | Average Side Street Delay: 50 seconds/vehicle (Lind/River and Webster) | Average Side Street Delay: 23 seconds/vehicle (Lind/River and Webster) | Average Side Street Delay: 35 seconds/vehicle (Lind/River and Webster) | Did not model this option | Did not model this option | Average Side Street Delay: 402 seconds/vehicle (EB TH 14 Exit Ramp) | Average Side Street Delay: 23 seconds/vehicle (EB TH 14 Exit Ramp) | Average Side Street Delay: 19 seconds/vehicle (EB and WB TH 14 Exit Ramps) | Average Side Street Delay: 115 seconds/vehicle (EB and WB TH 14 Exit Ramps) | Quantitative - Reduction in side street delay<br>Green: Side street delay is reduced from the no build scenario<br>Yellow: Side street delay remains the same as the no build scenario<br>Red: Side street delay is increased from the no build scenario<br>Baseline/2040 No Build Average Peak Hour Side Street Delay:<br>Lind/River/Webster: 32 seconds/vehicle [comparison for 1a-1c]<br>EB TH 14 Exit Ramp: 361 seconds/vehicle [comparison for 2b and 2c]<br>EB and WB TH 14 Exit Ramps: 125 seconds/vehicle [comparison for 2d and 2e] |
| | Understand and plan for freight needs. | | | | | | | | | | | Qualitative - adequate access and truck turning movements to existing and planned industrial areas |
| | Meets access spacing guidelines. | Recommended spacing is only met from River Ln to Monroe Ave | 0.22 miles between TH 14 and River/Lind | 0.22 miles between TH 14 and River/Lind | 0.08 miles between TH 14 and River/Lind NB U-Turn | 0.41 miles between TH 14 and Webster Interchange | NA - Depends on pairing | NA - Depends on pairing | NA - Depends on pairing | NA - Depends on pairing | NA - Depends on pairing | Quantitative - meets access spacing guidelines.<br>Recommended spacing is 0.5 mile from Lake St to Lind St (Subcategory A) and 0.25 mile from Lind St to Belgrade Ave (Subcategory B) according to the MnDOT Access Management Manual |
| | Improves access spacing over existing conditions | | | | | | NA - Depends on pairing | NA - Depends on pairing | NA - Depends on pairing | NA - Depends on pairing | NA - Depends on pairing | Quantitative<br>Green - improves access spacing<br>Red - does not improve access spacing |
| | Provide a connected transportation system that accommodates trips consistent with roadway functional class. | | | | | | | | | | | Qualitative - are the right trips on the right roads per functional classification |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Perceived pedestrian/bicyclist level of comfort. | | | | | | NA | NA | NA | NA | NA | Qualitative = Signalized intersections give pedestrian "WALK" indication, but traffic is traveling at a higher speed; Roundabout reduces traffic speed and pedestrian-vehicle conflict points but crossing relies on vehicles yielding to pedestrian; RCUT requires all red phase to accommodate pedestrians; An interchange would grade separate pedestrians from mainline TH 169 traffic |
| | Accommodate future transit plans and needs. | | | | | | | | | | | Qualitative |
| | Understand and plan for roadway expansion needs. | | | | | | | | | | | Qualitative - infrastructure can be built for future expansion |
| **GOAL C: Safely accommodate all system users.** | Reduce crash and severity rates. | | | | | | | | | | | Quantitative - Retaining traffic signal would not reduce crash/severity rates; 2x1 roundabouts would likely increase crashes but reduce crash severity; RCUTs have been shown to reduce crash/severity rates; Full cloverleaf introduces new weave areas; Signal (2c) would reduce angle crashes but likely increase rear end crashes; DDI would add signals likely increasing rear end crashes |
| | Provide safe pedestrian and bicycle travel near and across roadways, to area schools, and to regional destinations. | 16 | 16 | 8* | 14 | Did not draw this concept | NA | NA | NA | NA | NA | Quantitative - number of vehicle-pedestrian conflict points.<br>*Roundabout concept drawing shows pedestrian facilities on all legs of Lind/River intersection but conflict points were only counted for the crossing on the south leg as the other concepts assumed pedestrian facilities on south leg only (Webster and Lind/River). |
| **GOAL D: Provide infrastructure improvements that respect the environment.*** | Avoid, minimize, and mitigate impacts to historic properties. | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis |
| | Avoid, minimize, and mitigate impacts to cultural resources. | Low Risk | Medium Risk | Medium Risk | Medium Risk | Low Risk | Medium Risk | Low Risk | Low Risk | Medium Risk | Medium Risk | Quantitative - New road alignment north of Hiniker Pond and TH 14 ramp adjustments pose medium risk for impacts that will need to be studied with a future project. |
| | Avoid, minimize, and mitigate impacts to the built environment. | 0 takes | 4 partial takes | 4 partial takes | 4 partial takes | 6 total and 4 partial takes | 1 total and 2 partial takes | 0 takes | 0 takes | 0 takes | 0 takes | Quantitative - TH 169 N to US 14 E ramp would impact McDonalds building |
| | Avoid, minimize, and mitigate impacts to sensitive environmental resources. | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | High Risk | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - The full interchange configuration Option 2A would warrant modifications to the Minnesota River flood control structure that protects the City of Mankato and North Mankato from flood waters produced by the Minnesota River. Further coordination with FEMA will be required to understand the requirements associated with levee modifications or relocations associated with Option 2A. - US 14 W to TH 169 ramp would impact the existing wetland in the NE quadrant. |
| | Avoid, minimize, and mitigate impacts to hazardous contaminated areas. | Low Risk | Medium Risk | High Risk | High Risk | High Risk | High Risk | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Based on environmental screening there are several hazardous waste areas south of the TH 14 interchange, most south of Hiniker Pond |
| | Disproportionate impact to EJ populations | High Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | This is a two pronged analysis with a yes (red cell) or no (green cell) rating. 1) To have an EJ impact, there must first be an impact. In other words, a red cell somewhere else in this table. 2) If there is an impact, we need to determine if it will be "disproportionately high" on EJ communities. Because there are no EJ residences within close proximity in the northern sub area (they are east of the river) and because we have no data to lead us to believe that EJ populations use this area significantly more than other populations (i.e., travel to the corridor or drive through it), there is no reason to assume impacts would be disproportionately high. |
| **GOAL E: Develop a financially responsible implementation plan.** | Right-size improvements to address needs yet maximize use of existing infrastructure where possible. | Baseline | | | | | | | | | | Quantitative - general project footprint, retaining walls, etc. |
| | Develop fiscally responsible improvements (construction cost) | Baseline | $ 3.7M | $ 7.3M | $ 8.6M | $$$ 25M | $$ 13M | $ 4.6M | $ 2.5M | $ 9M | $ 8.7M | Quantitative - high level construction project cost in 2023 dollars, contingency, engineering. Does not include R/W or environmental (levee recontsruction)<br>$ = 1-10M, $$ = 10-20M, $$$ = 20M+ |
| | Develop fiscally responsible improvements (Impact (ROW and Env) costs) | Baseline | Medium Risk | Medium Risk | Medium Risk | High Risk | High Risk | Low Risk | Low Risk | Low Risk | Low Risk | Alternatives 1a, 1b, 1c – involve the realignment of the Lind St./River Ln. intersection, a "Medium" risk. Alternative 1d – the Webster interchange alternative involves several parcel impacts resulting in a "High" risk rating. Alternative 2a – this alternative carries the same parcel impacts as Alt. 1d, and additional property and environmental impacts at the Hwy 14/169 interchange. Alternatives – 2b, 2c, 2d, 2e – all improvements maintained within existing ROW with no environmental concerns. |
| | Develop project phases that meet schedule and funding constraints and maximize opportunities. | Baseline | | | | | | | | | | Qualitative - ability to be phased with MnDOT investment plans and agency funding availability |
| | Develop a supported funding model to clearly identify agency responsibilities. | Baseline | | | | | | | | | | Qualitative - combination of funding competitiveness and agency support |
| | Position partner agencies to seek federal and state grants for identified improvements to minimize partner costs. | Baseline | | | | | | | | | | Qualitative - Funding competitiveness based on concept ability to reduce/eliminate severe and fatal crashes, improve non-motorized safety and mobility, and gain agency/community support. |
| **GOAL F: Develop a plan supported by all agency partners.** | Supported by the PMT | | | | | | | | | | | Quantitative |

***Assessment based on planning-level concepts and will require further review to verify actual impacts.**

## Weighted Scores

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Goal A** | 6 | 60 | 60 | -12 | -12 | -24 | 48 | 42 | 48 | 48 |
| **Goal B** | -66 | 66 | 72 | 60 | 120 | 96 | 0 | 90 | 96 | 18 |
| **Goal C** | -15 | -15 | 45 | 45 | 60 | -30 | 15 | 15 | 15 | 15 |
| **Goal D** | 12 | 13.5 | 9 | 9 | 6 | -1.5 | 18 | 18 | 16.5 | 16.5 |
| **Goal E** | 0 | 10.5 | 16.5 | 13.5 | -18 | -9 | 6 | 18 | 18 | 6 |
| **Preliminary Total Score** | -63 | 135 | 202.5 | 115.5 | 156 | 31.5 | 87 | 183 | 193.5 | 103.5 |

| *Weighting Percent Per Goal* |
|---|
| 2 |
| 2 |
| 5 |
| 0.5 |
| 0.5 |

# Highway 169 Evaluation

## Northern Subarea Grade Separated Pedestrian Crossings

| | |
|---|---|
| Does Not Meet Measure/ High Risk | -6 pts |
| Minimally Meets Measure/ Medium Risk | 3 pts |
| Meets Measure/ Low Risk | 6 pts |

| Goals | Objectives | No Build | Grade Separated Ped Crossings | | | Notes |
|---|---|---|---|---|---|---|
| | | | A | B | C | |
| | | | Across TH 169 & MN river using existing TH 14 bridges | Crossing north of Lind St | Crossing south side of Webster Ave | |
| **GOAL A: Preserve community connections and economic vitality.** | Provide convenient pedestrian and bicycle access to regional destinations. | Baseline | | | | Qualitative - Webster Ave is more of a local destination than a regional destination in comparison to Lind Court and Lind Street destinations and connections to existing regional trails. |
| **GOAL B: Provide efficient and reliable mobility for all users.** | Perceived pedestrian/bicyclist level of comfort. | | | | | Quantitative - No Build gives pedestrian "WALK" indication, but traffic is traveling at a higher speed; Utilizing the existing TH 14 bridges will not completely separate peds/bikes from traffic like standalone ped bridges will. |
| **GOAL C: Safely accommodate all system users.** | Reduce crash and severity rates. | | | | | Quantitative |
| | Provide safe pedestrian and bicycle travel near and across Highway 169. | 16 | 0 | 0 | 0 | Quantitative - number of vehicle-pedestrian conflict points |
| **GOAL D: Provide infrastructure improvements that respect the environment.*** | Avoid, minimize, and mitigate impacts to historic properties. | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative -Will require future detailed analysis. |
| | Avoid, minimize, and mitigate impacts to cultural resources. | Low Risk | Medium Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis of grades and alignments. Trail connections needed with the TH 14 bridges connection could potentially disturb areas along the MN River. |
| | Avoid, minimize, and mitigate impacts to the built environment. | 0 takes | 0 takes | 1 partial impact | 1 partial impact | Quantitative - Will require future detailed analysis of grades and bridge type foot print. Built out environment could result in some partial property impacts. |
| | Avoid, minimize, and mitigate impacts to sensitive environmental resources. | Low Risk | Medium Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis of grades and alignments. Trail connections needed with the TH 14 bridges connection could potentially disturb areas along the MN River. |
| | Avoid, minimize, and mitigate impacts to hazardous contaminated areas. | Low Risk | Low Risk | Low Risk | Medium Risk | Quantitative - Will require future detailed analysis. Based on environmental screening there are several hazardous waste areas south of the TH 14 interchange, most south of Hiniker Pond. |
| | Disproportionate impact to EJ populations | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Low risk given consideration all proposed roadway concepts provide more safe and connected at grade crossings than existing conditions and a pedestrian bridge could be paired with any improvement concept. |
| **GOAL E: Develop a financially responsible implementation plan.** | Right-size improvements to address needs yet maximize use of existing infrastructure where possible. | Baseline | | | | Quantitative - general project footprint, retaining walls, etc. |
| | Develop fiscally responsible improvements | Baseline | $$ 4M | $$ 4M | $$ 5M | Quantitative - high level project cost in 2023 dollars, contingency, engineering $ = 1-3M, $$ = 4-6M, $$$ = 6M+ |
| | Develop project phases that meet schedule and funding constraints and maximize opportunities. | Baseline | | | | Qualitative - ability to be phased with MnDOT investment plans and agency funding availability |
| | Develop a supported funding model to clearly identify agency responsibilities. | Baseline | | | | Qualitative - combination of funding competitiveness and agency support |
| | Position partner agencies to seek federal and state grants for identified improvements to minimize partner costs. | Baseline | | | | Qualitative - Funding competitiveness based on concept anticipated use, ability to reduce/eliminate severe and fatal crashes, improve non-motorized safety and mobility, and gain agency/community support. |
| **GOAL F: Develop a plan supported by all agency partners.** | Supported by the PMT | | | | | Quantitative |

***Assessment based on planning-level concepts and will require further review to verify actual impacts.**

# Highway 169 Evaluation

## Northern Subarea Local System Evaluation Summary

| | |
|---|---|
| Does Not Meet Measure/ High Risk | -6 pts |
| Minimally Meets Measure/ Medium Risk | 3 pts |
| Meets Measure/ Low Risk | 6 pts |

| Goals | Objectives | Local System Concepts | | | | Notes |
|---|---|---|---|---|---|---|
| | | L1 | L2 | L3 | L4 | |
| | | Range St remains open (no change) | Range St Cul-de-Sac | Range St RIRO at Webster Ave | Range St Modernization | |
| **GOAL A: Preserve community connections and economic vitality.** | Maintain sustainable access for local trips into/out of Mankato and North Mankato. | | | | | Qualitative - design, system connectivity, and agency support |
| | Accommodate reasonable vehicle/truck access. | | | | | Qualitative - Agency and public perception |
| | Maintain emergency access routes into/out of Mankato and North Mankato. | | | | | Qualitative - design, system connectivity, traffic calming impacts to response times |
| **GOAL B: Provide efficient and reliable mobility for all users.** | Understand and plan for freight needs. | | | | | Qualitative - adequate access and truck turning movements to existing and planned industrial areas |
| | Meets access spacing guidelines. | | | | | Quantitative - meets access spacing guidelines, relative to Hwy 169 concepts paired with |
| | Accommodate future transit plans and needs. | | | | | Quantitative - Route 5 travels Range St to cross TH 169 at Belgrade Ave |
| **GOAL C: Safely accommodate all system users.** | Reduce crash and severity rates. | | | | | Quantitative - with L1 and L4 Webster Avenue will continue to see crash issues |
| **GOAL D: Provide infrastructure improvements that respect the environment.*** | Avoid, minimize, and mitigate impacts to historic properties. | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. All options could likely be constructed within the footprint of the existing intersection. |
| | Avoid, minimize, and mitigate impacts to cultural resources. | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. All options could likely be constructed within the footprint of the existing intersection. |
| | Avoid, minimize, and mitigate impacts to the built environment. | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. All options could likely be constructed within the footprint of the existing intersection. |
| | Avoid, minimize, and mitigate impacts to sensitive environmental resources. | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. All options could likely be constructed within the footprint of the existing intersection. |
| | Avoid, minimize, and mitigate impacts to hazardous contaminated areas. | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. All options could likely be constructed within the footprint of the existing intersection. |
| | Disproportionate impact to EJ populations | Low Risk | Low Risk | Low Risk | Low Risk | Quantitative - Low risk given consideration that most options could be paired with any improvement concept. |
| **GOAL F: Develop a plan supported by all agency partners.** | Supported by the PMT | | | | | Quantitative |

***Assessment based on planning-level concepts and will require further review to verify actual impacts.**

# Highway 169 Evaluation

## Southern Subarea Concept Evaluation Summary

Does Not Meet Measure/ High Risk: -6 pts | Minimally Meets Measure/ Medium Risk: 3 pts | Meets Measure/ Low Risk: 6 pts

| Goals | Objectives | No Build | Highway 169 Concepts | | | | | | | | Local System Concepts | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1a | 1b | 1c | 1d | 2a | 2b1 | 2b2 | 2c | 3a | 3b | |
| | | | Restrict access @ Hawley & Amos Owen & CSAH 33 | EB right only @ Hawley, restrict access @ Amos Owen & CSAH 33 | Green T @ Hawley, restrict access @ Amos Owen & CSAH 33 | Restrict access @ Hawley & Amos Owen, Green T @ CSAH 33 | High-T at TH 68, restrict access @ business' & CR 120 & CSAH 69 | High-T at TH 68 & consolidate access near CSAH 69 | R-in/R-out at TH 68 & consolidate access near CSAH 69 | RCUT's @ CR 120 & CSAH 69, add TH 68 south leg, close Bison | Close 208th/Loren, restrict access @ TH 60 & Gadwall | Close 208th & Loren & CR 117, realign Gadwall | |
| **GOAL A: Preserve community connections and economic vitality.** | Maintain sustainable access for local trips. | | | | | | | | | | | | Quantitative - travel time and network efficiency |
| | Maintain emergency access routes. | | | | | | | | | | | | Qualitative - design, system connectivity, traffic calming impacts to response times |
| | Accommodate reasonable vehicle/truck access | | | | | | | | | | | | Qualitative - Agency and public perception<br>Green: Minimal or no re-routing of trips<br>Yellow: A few movements need to be re-routed<br>Red: Several movements need to be re-routed |
| | Accommodate reasonable ped/bike access | | | | | | NA | NA | NA | NA | NA | NA | Qualitative - Agency and public perception |
| | Enhance community identity. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | Qualitative - median areas provide opportunity for aesthetics/monumentation |
| **GOAL B: Provide efficient and reliable mobility for all users.** | Provide acceptable system reliability serving existing and planned growth. | | WBLs at CSAH 33 and Hawley operate with LOS F | WBL at CSAH 33 and U-Turns at RCUTs operate with LOS F | Operations are acceptable with all WBLs at Green T | Operations are acceptable with all WBLs at Green T | | Did not model this option | Operations accpetable with signal at full movement access | Did not model this option | | Did not model this option - But NBL at TH 60 operate with LOS F with existing control/full access | Quantitative - serves existing and forecasted ADT |
| | Provide acceptable regional highway travel times while accommodating reliable local access. | Baseline | | | | | | Did not model this option | | Did not model this option | | Did not model this option | Quantitative - average through trip time<br>Green - adds <60 seconds<br>Yellow - adds 60-120 seconds<br>Red - adds 120+ seconds |
| | Provide acceptable side street delay | Several movements operate with LOS F | | | | | | Did not model this option | | Did not model this option | | Did not model this option - But NBL at TH 60 operate with LOS F with existing control/full access | Quantitative - side street LOS<br>Green: All side street movements operate with LOS A - D<br>Yellow: Side street movements operate with LOS E<br>Red: Side street movements operate with LOS F |
| | Improves side street delay over existing conditions | Baseline | Average Side Street Delay: 2 seconds/vehicle | Average Side Street Delay: 2 seconds/vehicle | Average Side Street Delay: 4 seconds/vehicle | Average Side Street Delay: 5 seconds/vehicle | Average Side Street Delay: 6 seconds/vehicle | Did not model this option | Average Side Street Delay: 41 seconds/vehicle | Did not model this option | Average Side Street Delay: 2 seconds/vehicle | Did not model this option - Excessive side street delay anticipated with full access and stop control | Quantitative - Reduction in side street delay<br>Green: Side street delay is reduced from the no build scenario<br>Yellow: Side street delay remains the same as the no build scenario<br>Red: Side street delay is increased from the no build scenario<br>Baseline/2040 No Build Average Peak Hour Side Street Delay:<br>Section 1: 327 seconds/vehicle<br>Section 2: 51 seconds/vehicle<br>Section 3: 102 seconds/vehicle |
| | Understand and plan for freight needs. | | | | | | | | | | | | Qualitative - adequate access and truck turning movements to existing and planned industrial areas |
| | Meets access spacing guidelines. | Only met CSAH 33 to Bison St and CSAH 117 to Loren Dr | Alternative does not change access spacing | Alternative does not change access spacing | Alternative does not change access spacing | Alternative does not change access spacing | TH 68-CSAH 69 = 0.46 miles<br>CSAH 69-CSAH 120 = 0.47 miles | | | Alternative does not change access spacing | CSAH 117 to CSAH 90 = 0.25 miles | | Quantitative - meets access spacing guidelines. Recommended spacing is 0.5 mile according to the MnDOT Access Management Manual |
| | Improves access spacing over existing conditions | | | | | | | | | | | | Quantitative<br>Green - improves access spacing<br>Red - does not improve access spacing |
| | Provide a connected transportation system that accommodates trips consistent with roadway functional class. | | | | | | | | | | | | Quantitative - are the right trips on the right roads per functional classification |
| | Perceived pedestrian/bicyclist level of comfort | | | | | | NA | NA | NA | NA | NA | NA | Qualitative - All concepts require pedestrians to cross multiple lanes of free flowing high speed traffic |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accommodate future transit plans and needs. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | Quantitative |
| | Understand and plan for roadway expansion needs. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | Qualitative - infrastructure can be built for future expansion |
| **GOAL C: Safely accommodate all system users.** | Reduce crash and severity rates. | | | | | | | | | | | | Quantitative - Reducing access would reduce crash rate and severity. Green-T would reduce severe crashes, but increase rear end crashes with a signal added along TH 169 |
| | Provide safe pedestrian and bicycle travel near and across roadways, to area schools, and to regional destinations. | 7 | 7 | 7 | 8 | 7 | NA | NA | NA | NA | NA | NA | Quantitative - number of pedestrian conflict points |
| **GOAL D: Provide infrastructure improvements that respect the environment.*** | Avoid, minimize, and mitigate impacts to historic properties. | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Will require future detailed analysis |
| | Avoid, minimize, and mitigate impacts to cultural resources. | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Will require future detailed analysis |
| | Avoid, minimize, and mitigate impacts to the built environment. | 0 takes | 0 takes | 0 takes | 0 takes | 0 takes | 1 partial take | 1 total and 1 partial take | 3 partial takes | 3 total and 4 partial takes | 5 partial takes | 2 total and 2 partial takes | For 2B1 a total take west of the Hwy 69 intersection is an undeveloped property. For 2c the total takes would impact existing residential properties. |
| | Avoid, minimize, and mitigate impacts to sensitive environmental resources. | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Will require future detailed analysis |
| | Avoid, minimize, and mitigate impacts to hazardous contaminated areas. | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Medium Risk | Medium Risk | Low Risk | Low Risk | Low Risk | To be considered for 2B1 and based on environmental screening there is a hazardous waste area near the Hwy 120 intersection. |
| | Disproportionate impact to EJ populations | High Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | Low Risk | This is a two pronged analysis with a yes (red cell) or no (green cell) rating. 1) To have an EJ impact, there must first be an impact. In other words, a red cell somewhere else in this table. 2) If there is an impact, we need to determine if it will be "disproportionately high" on EJ communities. Because we have no data to lead us to believe that EJ populations use this area significantly more than other populations (i.e., travel to the corridor or drive through it), there is no reason to assume impacts would be disproportionately high. |
| | Right-size improvements to address needs yet maximize use of existing infrastructure where possible. | | | | | | | | | | | | Quantitative - general project footprint, retaining walls, etc. |
| **GOAL E: Develop a financially responsible implementation plan.** | Develop fiscally responsible improvements (construction cost) | Baseline | $ 4M | $ 3.2M | $ 5.1M | $ 4.7M | $$$ 22.2M | $$$ 22.6M | $ 5.6M | $ 9M | $ 1.9M | $ 5M | Quantitative - high level project cost in 2023 dollars, contingency, engineering<br>$ = 1-10M, $$ = 10-20M, $$$ = 20M+ |
| | Develop fiscally responsible improvements (Impact (ROW and Env) costs) | Baseline | Low Risk | Low Risk | Low Risk | Low Risk | High Risk | High Risk | Medium Risk | High Risk | Medium Risk | Medium Risk | There is risk associated with the High T at CR 68 and the proximity of the railroad/trail bridge. For 2c the total takes would impact existing residential properties. |
| | Develop project phases that meet schedule and funding constraints and maximize opportunities. | Baseline | | | | | | | | | | | Qualitative - ability to be phased with agency investment plans and agency funding availability |
| | Develop a supported funding model to clearly identify agency responsibilities. | Baseline | | | | | | | | | | | Qualitative - combination of funding competitiveness and agency support |
| | Position partner agencies to seek federal and state grants for identified improvements to minimize partner costs. | Baseline | | | | | | | | | | | Qualitative - Funding competitiveness based on concept ability to reduce/eliminate severe and fatal crashes, improve non-motorized safety and mobility, and gain agency/community support. |
| **GOAL F: Develop a plan supported by all agency partners.** | Supported by the PMT | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | Quantitative |

***Assessment based on planning-level concepts and will require further review to verify actual impacts.**

## Weighted Scores

| | | | | | | | | | | | *Weighting Percent Per Goal* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Goal A** | **24** | **0** | **-6** | **12** | **18** | **36** | **30** | **30** | **24** | **36** | **36** | 2 |
| **Goal B** | **-66** | **0** | **-18** | 36 | **24** | **72** | **96** | **96** | **48** | **60** | **24** | 2 |
| **Goal C** | **-60** | **0** | **0** | **-15** | **-15** | **30** | **30** | **30** | **30** | **30** | **30** | 5 |
| **Goal D** | **12** | **18** | **18** | **18** | **18** | **16.5** | **15** | **15** | **12** | **16.5** | **12** | 0.5 |
| **Goal E** | **-3** | **16.5** | **16.5** | **16.5** | **16.5** | **0** | **0** | **16.5** | **12** | **15** | **13.5** | 0.5 |
| **Preliminary Total Score** | **-93** | **34.5** | **10.5** | **67.5** | **61.5** | **154.5** | **171** | **187.5** | **126** | **157.5** | **115.5** | |

# Highway 169 Evaluation

## Southern Subarea Grade Separated Ped Crossings

| | |
|---|---|
| Does Not Meet Measure/ High Risk | -6 pts |
| Minimally Meets Measure/ Medium Risk | 3 pts |
| Meets Measure/ Low Risk | 6 pts |

| Goals | Objectives | No Build | Separated Ped Crossings | | Notes |
|---|---|---|---|---|---|
| | | | A | B | |
| | | | Across TH 169 at Hawley Street | Across TH 169 just west of Blue Earth River | |
| **GOAL A: Preserve community connections and economic vitality.** | Provide convenient pedestrian and bicycle access to local and regional destinations. | Baseline | | | Qualitative - The Hawley Street location provides more direct access to the convenient store which is a popular local destination. |
| **GOAL B: Provide efficient and reliable mobility for all users.** | Perceived pedestrian/bicyclist level of comfort. | | | | Quantitative - Both options provide complete separation between peds and bikes. |
| **GOAL C: Safely accommodate all system users.** | Reduce crash and severity rates. | | | | Quantitative |
| | Provide safe pedestrian and bicycle travel near and across Highway 169. | | 0 | 0 | Quantitative - number of vehicle-pedestrian conflict points |
| **GOAL D: Provide infrastructure improvements that respect the environment.*** | Avoid, minimize, and mitigate impacts to historic properties. | Low Risk | Low Risk | Low Risk | Quantitative -Will require future detailed analysis. |
| | Avoid, minimize, and mitigate impacts to cultural resources. | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. |
| | Avoid, minimize, and mitigate impacts to the built environment. | 0 takes | 0 takes | 0 takes | Quantitative |
| | Avoid, minimize, and mitigate impacts to sensitive environmental resources. | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. |
| | Avoid, minimize, and mitigate impacts to hazardous contaminated areas. | Low Risk | Low Risk | Low Risk | Quantitative - Will require future detailed analysis. |
| | Disproportionate impact to EJ populations | High Risk | Low Risk | Low Risk | Quantitative - No Build is high risk given consideration that existing conditions and all proposed concepts do not provide safe pedestrian crossings of Hwy 169. |
| **GOAL E: Develop a financially responsible implementation plan.** | Right-size improvements to address needs yet maximize use of existing infrastructure where possible. | Baseline | | | Quantitative - general project footprint, retaining walls, etc. |
| | Develop fiscally responsible improvements (construction cost) | Baseline | $$ 5M | $$ 4M | Quantitative - high level project cost in 2023 dollars, contingency, engineering $ = 1-3M, $$ = 3-6M, $$$ = 6M+ |
| | Develop project phases that meet schedule and funding constraints and maximize opportunities. | Baseline | | | Qualitative - ability to be phased with MnDOT investment plans and agency funding availability |
| | Develop a supported funding model to clearly identify agency responsibilities. | Baseline | | | Qualitative - combination of funding competitiveness and agency support |
| | Position partner agencies to seek federal and state grants for identified improvements to minimize partner costs. | Baseline | | | Qualitative - Funding competitiveness based on concept anticipated use, ability to reduce/eliminate severe and fatal crashes, improve non-motorized safety and mobility, and gain agency/community support. |
| **GOAL F: Develop a plan supported by all agency partners.** | Supported by the PMT | TBD | TBD | TBD | Quantitative |

***Assessment based on planning-level concepts and will require further review to verify actual impacts.**

# Evaluation Memo Appendix B

TRAFFIC ANALYIS MEMEORANDUM

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

# Highway 169 Corridor Study

## Concept Traffic Operations Evaluation

**Date:** August 25, 2021

**To:** Charles Androsky, Transportation Planner, MAPO

**From:** Scott McBride, PE, Project Manager, Bolton & Menk, Inc.

Kelsey Retherford, PE, Traffic Engineer, Bolton & Menk, Inc.

**Subject:** Concept Traffic Operations Evaluation

Highway 169 Corridor Study

Mankato/North Mankato Area Planning Organization (MAPO)

BOLTON & MENK
Real People. Real Solutions.

# Introduction

The Mankato/North Mankato Area Planning Organization (MAPO) in collaboration with the Cities of North Mankato, Mankato, Blue Earth County, Nicollet County, and the Minnesota Department of Transportation (MnDOT) are working to identify transportation improvements on Highway 169. This report summarizes the future traffic analysis of Highway 169 in the Northern Subarea from Lake St to the Veterans' Memorial Bridge and in the southern subarea from the Blue Earth River Crossing to Highway 60.

# Northern Subarea

The northern subarea extends from Lake St to the Veterans' Memorial Bridge. This segment is a four-lane divided expressway withing the Cities of Mankato and North Mankato. This subarea has a large concentration of commercial, heavy industrial, light industrial, residential, and public/institutional land uses served by Lind St and Webster Ave connections to Highway 169.

## Concepts

Throughout the northern subarea four overall options were derived with several sub options to analyze various traffic control. These options are described below:

- **Concept 1 – Spot Intersection Improvements**
  - Signalized Green-T at EB TH 14 Exit Ramp
  - Local system concepts
    - Range St remain Full Access (no change from existing)
    - Range St Cul-de-sac
    - Range St Right-In/Right-Out
    - Range St Modernization
- **Concept 2 – Access Relocation (Combine Lind St/River Ln)**
  - Signals at combined Lind St/River Ln and Webster Ave intersections
  - Roundabouts at combined Lind St/River Ln and Webster Ave intersections
  - Signalized RCUTs at combined Lind St/River Ln and Webster Ave intersections
- **Concept 3 – Combined Intersection (Lind St/River Ln/Webster Ave)**
  - At grade signal at combined Lind St/River Ln/Webster Ave intersection
  - Interchange at combined Lind St/River Ln/Webster Ave intersection
- **Concept 4 – TH 14 Interchange Improvements**
  - Full cloverleaf interchange
  - Eliminate South Loop
    - Roundabout at EB TH 14 Ramps
    - Signal at EB TH 14 Ramps
  - Eliminate Both Loops
    - Diverging Diamond
    - Roundabouts
  - Signalize EB TH 14 exit ramp at TH 169

## Traffic Operations

A level of service (LOS) analysis of the 2040 peak hours was completed using the forecasted turning movement counts in Synchro/SimTraffic for the signalized/stop-controlled intersections and in Vissim for roundabouts. Traffic operations were not analyzed for the local system concepts at Range St. This is because traffic volumes were not collected at this intersection and it is outside the project limits. The four local system concepts were derived to show a full range of options at the intersection of Range St and Webster Ave as traffic queuing from the TH 169 and Webster Ave intersection extends beyond Range St during the peak hours. The operations for the Northern Subarea concepts analyzed are shown in **Tables 1** through **4** below.

**Table 1. Concept 1 – 2040 Build Traffic Operations**

| Intersection | Traffic Control | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| EB TH 14 Exit Ramp at TH 169 | Signalized Green T | 12 | B | EBL | 45 | D | 300 | 9 | A | EBL | 49 | D | 300 |

*Delay in seconds per vehicle.

**Table 1** shows the traffic operations with a signalized Green-T at the intersection of TH 169 and EB TH 14 exit ramp. This shows that the concept would operate well with the overall peak hours operating with LOS A or B and all movements operating with LOS D or better. However, the preliminary concept design of this concept showed that the northbound left turn lane for the WB TH 14 entrance ramp is located too close to the TH 169 at EB TH 14 exit ramp intersection. Specifically, the crossover between the eastbound left traffic from the EB TH 14 exit ramp and the northbound left traffic at the WB TH 14 entrance ramp is a crash concern and therefore this concept was dismissed from further evaluation. The detailed 2040 traffic operations are included in **Tables A1** and **A2** of **Appendix A** and a concept drawing of the concept is included in **Appendix B**.

**Table 2. Concept 2 – 2040 Build Traffic Operations**

| Intersection | Traffic Control | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| Lind St/River Ln at TH 169 | Signal | 33 | C | SBL | 75 | E | 400 | 32 | C | SBL | 96 | F | 450 |
| Webster Ave at TH 169 | | 28 | C | SBL | 72 | E | 50 | 30 | C | SBL | 79 | E | 125 |
| Lind St/River Ln at TH 169 | Roundabout** | 7 | A | EBT | 68 | F | 250 | 8 | A | EBT | 59 | F | 200 |
| Webster Ave at TH 169 | | 11 | B | WBL | 68 | F | 200 | 10 | B | WBL/T | 52 | F | 225 |
| Lind St/River Ln NB U-Turn at TH 169 | Signalized RCUTs | 4 | A | NBU | 33 | C | 125 | 4 | A | NBU | 32 | C | 175 |
| Lind St/River Ln at TH 169 | | 17 | B | NBL | 47 | D | 50 | 30 | C | SBL | 76 | E | 500 |
| Lind St/River Ln SB U-Turn at TH 169 | | 5 | A | SBU | 73 | E | 200 | 4 | A | SBU | 63 | E | 150 |
| Webster Ave NB U-Turn at TH 169 | | 4 | A | NBU | 72 | E | 125 | 4 | A | NBU | 74 | E | 175 |
| Webster Ave at TH 169 | | 12 | B | NBL | 49 | D | 150 | 17 | B | NBL | 44 | D | 175 |
| Webster Ave SB U-Turn at TH 169 | | 10 | B | SBU | 39 | D | 300 | 7 | A | SBU | 27 | C | 300 |

*Delay in seconds per vehicle.
**Operational Analysis from Vissim

**Table 2** shows the traffic operations with signals, roundabouts, and signalized RCUTs at the combined Lind St/River Ln intersection with TH 169 and the intersection of Webster Ave at TH 169. This shows that each concept is anticipated to operate with LOS C or better for the intersection overall during both peak hours. The roundabouts operate with the lowest intersection delay of the three traffic control concepts analyzed. The maximum movement delay is also lowest with the roundabouts, however, the LOS indicates some movements are anticipated to operate with LOS F. This is because the delay thresholds associated with LOS for a roundabout are based on a stop controlled intersection which have lower delay thresholds than a signalized

intersection. The signalized RCUTs analysis shows that all movements are anticipated to operate with LOS E or better. The signal analysis shows that the SBL during the AM peak at the combined Lind St/River Ln intersection is anticipated to operate with LOS F, but all other movements operate with LOS E or better. The detailed 2040 traffic operations are included in **Tables A3** through **A8** of **Appendix A** and concept drawings of the concepts which show lane configuration assumptions with each concept are included in **Appendix B**.

**Table 3. Concept 3 – 2040 Build Traffic Operations**

| Intersection | Traffic Control | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| ***Signalized At Grade Intersection*** | | | | | | | | | | | | | |
| Lind St/River Ln/Webster Ave at TH 169 | Signal | 41 | D | EBL | 96 | F | 325 | 45 | D | WBL | 90 | F | 275 |
| ***Interchange*** | | | | | | | | | | | | | |
| SB TH 169 Ramps | Roundabout | 6 | A | EBT | 8 | A | 175 | 11 | B | SBL/SBR | 17 | B | 325 |
| NB TH 169 Ramps | | 18 | C | WBR | 27 | D | 500 | 10 | B | WBT | 18 | C | 350 |

*Delay in seconds per vehicle.

**Table 3** shows the traffic operations with an at grade signal or grade separated interchange at a combined Lind St/River Ln/Webster Ave intersection with TH 169. This shows that a signal would operate with LOS D overall, however, the maximum delay movement would operate with LOS F during both peak hours. All other movements are anticipated to operate with LOS E or better. This concept was analyzed with channelized left and right turn lanes on the northbound, southbound, and westbound approaches. A dual left turn lane and channelized right turn lane was assumed for the eastbound approach. This concept was not drawn as it was dismissed by the Project Management Team (PMT) due to concerns with the concept being too impactful to existing businesses and future redevelopment areas. The interchange option was assumed to have single lane roundabouts at the ramp terminals. This option operates well with all movements operating with LOS D or better during both peak hours. The detailed 2040 traffic operations are included in **Tables A9a** through **A10b** of **Appendix A.**

**Table 4. Concept 4 – 2040 Build Traffic Operations**

| Intersection | Traffic Control | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| ***Full Cloverleaf Interchange*** | | | | | | | | | | | | | |
| TH 14 at TH 169 | | 1 | A | SBR | 6 | A | 25 | 2 | A | SBR | 6 | A | 25 |
| ***Eliminate South Loop*** | | | | | | | | | | | | | |
| EB TH 14 Ramps at TH 169 | Roundabout** | 63 | F | EBR | 435 | F | 4900 | 45 | E | EBR | 444 | F | 3225 |
| | | | | | | | | | | | | | |
| EB TH 14 Ramps at TH 169 | Signal | 19 | B | SBL | 60 | E | 250 | 22 | C | SBL | 61 | E | 275 |
| ***Eliminate Both Loops*** | | | | | | | | | | | | | |
| TH 14 at TH 169 | Signal (Diverging Diamond) | 5** | A | EBL/WBL | 16 | B | 175/200 | 6** | A | WBL | 17 | B | 225 |
| | | | | | | | | | | | | | |
| WB TH 14 Ramps at TH 169 | Roundabout*** | 17 | C | SBR/WBL | 25 | D | 475/425 | 78 | F | WBR | 273 | F | 1650 |
| EB TH 14 Ramps at TH 169 | Roundabout*** | 22 | C | EBR | 123 | F | 1900 | 10 | A | EBR | 52 | F | 450 |
| ***Signalize EB TH 14 Exit Ramp*** | | | | | | | | | | | | | |
| EB TH 14 Ramps at TH 169 | Signal | 12 | B | EBL | 46 | D | 250 | 9 | A | EBL | 48 | D | 250 |

*Delay in seconds per vehicle.
**Overall Interchange Delay (average delay of all movements at the interchange)
***Operational Analysis from Vissim

**Table 4** shows the traffic operations for the TH 14 interchange improvement concepts. **Table 4** shows how a full cloverleaf interchange would operation with the lowest amount of delay and all movements operate with LOS A during both peak hours. **Table 4** also shows how eliminating the south loop and making the EB TH 14

ramp at TH 169 intersection a roundabout operates with excessive delay and queuing. The eastbound exit ramp is approximately 1650 ft in length so the maximum queues are anticipated to extend onto mainline TH 14 with a roundabout. With a signal at this intersection the overall delay is LOS B or C during the peak hours. The maximum movement delay with a signal is LOS E and queuing is anticipated to be minimal. **Table 4** shows how roundabouts or a diverging diamond will operate with both loops eliminated. This indicates that roundabouts at both ramp terminals will operate with excessive delay and queuing. The diverging diamond, however, operates well with an average delay of only 5-6 seconds per vehicle during both peak hours and the maximum movement delay operates with LOS B during both peak hours. Finally, **Table 4** shows how signalizing the EB TH 14 exit ramp would operate with minimal delay for the intersection overall and would reduce the eastbound left at the exit ramp from LOS F under the no build scenario to LOS D during both peak hours. The detailed 2040 traffic operations are included in **Tables A11** through **A18** of **Appendix A** and concept drawings of the concepts are included in **Appendix B**.

## Additional Traffic Analysis

### Vissim Analysis

An additional operational analysis was completed in Vissim to confirm that a signal at the TH 14 interchange would operate acceptably with roundabouts at Lind St/River Ln and Webster Ave. The operations are summarized in **Table 5** below.

**Table 5. Additional Vissim Analysis – 2040 Build Traffic Operations**

| Intersection | Traffic Control | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| EB TH 14 Exit Ramp at TH 169 | Signal | 18 | B | SBL | 66 | E | 350 | 17 | B | SBL | 62 | E | 325 |
| Lind St/River Ln at TH 169 | Roundabout | 8 | A | EBL | 45 | E | 225 | 9 | A | EBT | 41 | E | 175 |
| Webster Ave at TH 169 | | 10 | B | WBL | 67 | F | 200 | 10 | B | WBL | 42 | E | 200 |

**Table 5** indicates that a signal at the TH 14 exit ramp and TH 169 intersection is anticipated to operate acceptably with roundabouts at Lind St/River Ln and Webster Ave. In fact, the traffic operations indicate that a signal at TH 14 actually reduces the delay for the eastbound approach at Lind St/River Ln as the signal creates gaps in the southbound TH 169 mainline traffic instead of SB TH 169 being a free-flowing movement like it is today. The detailed 2040 traffic operations are included in **Tables A19** and **A20** of **Appendix A.**

### Sensitivity Analysis

A sensitivity analysis was completed for the eastbound TH 14 exit ramp to see how operations are anticipated to worsen over time as volumes increase. The results are shown in **Table 6**.

**Table 6. EB TH 14 Exit Ramp at TH 169 - Traffic Operations**

| Year | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | Queue Lengths (ft) | | | | Volumes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBT | | SBT | | EBL | | EBR | | EBL | | EBR | | EBL | EBR | SBT |
| | | | | | | | | | | | | Avg | Max | Avg | Max | | | |
| 2020 | AM | 5 | A | 0 | A | 1 | A | 31 | D | 11 | B | 100 | 175 | 75 | 175 | 158 | 250 | 818 |
| | PM | 7 | A | 0 | A | 1 | A | 81 | F | 11 | B | 125 | 275 | 75 | 225 | 150 | 163 | 1068 |
| 2025 | AM | 8 | A | 1 | A | 1 | A | 61 | F | 13 | B | 125 | 325 | 100 | 300 | 168 | 272 | 863 |
| | PM | 12 | B | 0 | A | 1 | A | 143 | F | 27 | D | 175 | 400 | 150 | 625 | 158 | 175 | 1128 |
| 2030 | AM | 10 | B | 0 | A | 1 | A | 82 | F | 14 | B | 150 | 350 | 100 | 205 | 178 | 294 | 908 |
| | PM | 18 | C | 1 | A | 1 | A | 214 | F | 39 | E | 250 | 450 | 250 | 800 | 165 | 187 | 1188 |
| 2035 | AM | 29 | D | 0 | A | 1 | A | 239 | F | 47 | E | 300 | 450 | 375 | 925 | 187 | 315 | 953 |
| | PM | 50 | F | 1 | A | 1 | A | 502 | F | 219 | F | 375 | 475 | 800 | 1800 | 173 | 199 | 1248 |
| 2040 | AM | 25 | D | 0 | A | 1 | A | 204 | F | 39 | E | 300 | 475 | 275 | 800 | 196 | 336 | 998 |
| | PM | 87 | F | 1 | A | 1 | A | 926 | F | 538 | F | 450 | 475 | 1475 | 2025 | 180 | 210 | 1308 |

1. Delay in seconds per vehicle

This shows how the existing (2020) peak hour shows failing operations for the eastbound left turn during the PM peak hour and by 2025 both peak hours show failing LOS for the eastbound left turn. It should be noted that video footage of the intersection could not be obtained to verify the existing condition due to non-normal traffic patterns because of COVID-19 so it is unclear if this delay is experienced by drivers today. Traffic volumes should be monitored to determine when a signal is needed to mitigate the delay for the eastbound left turn.

## Travel Time Analysis

A travel time analysis was completed during the 2040 AM and PM peak hours along northbound and southbound TH 169 to see how each option increases or decreases the travel time for mainline vehicles compared to the No Build scenario. The travel time was reported along the northern subarea between Lake St NW and Belgrade Ave for each concept. Each option was modeled only changing described improvement. All other intersections along the corridor were kept as the existing condition. **Table 7** shows the travel time for the 2040 No Build scenario and each of the northern subarea concepts. **Table 8** shows the change in travel time compared to the No Build scenario with the last row in **Table 8** showing the average change in travel time for both peak hours and both directions of travel.

**Table 7. Travel Time from Lake St NW to Belgrade Ave**

| Peak Hour | Direction | No Build | Highway 169 Concepts | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1a | 1b | 1c | 1d & 2a | 2b | 2c | 2d | 2e | 2f |
| | | | Combined River Ln / Lind St Signals | Combined River Ln / Lind St Roundabouts | Combined River Ln / Lind St RCUTs | TH 14 Interchange Full Cloverleaf and Webster Area Interchange | TH 14 Interchange Eliminate South Loop - Roundabout | TH 14 Interchange Eliminate South Loop - Signal | TH 14 Interchange Diverging Diamond | TH 14 Interchange Roundabout Ramp Intersections | TH 14 Interchange Signalize EB TH 14 Exit Ramp |
| AM | Northbound | 220 | 223 | 180 | 217 | 151 | 254 | 234 | 248 | 265 | 222 |
| | Southbound | 212 | 253 | 230 | 196 | 187 | 216 | 252 | 229 | 305 | 220 |
| PM | Northbound | 234 | 223 | 185 | 254 | 153 | 274 | 251 | 258 | 285 | 234 |
| | Southbound | 214 | 239 | 228 | 249 | 188 | 219 | 239 | 230 | 330 | 220 |

**Table 8. Change In Travel Time Compared to No Build from Lake St NW to Belgrade Ave**

| Peak Hour | Direction | No Build | Highway 169 Concepts | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1a | 1b | 1c | 1d & 2a | 2b | 2c | 2d | 2e | 2f |
| | | | Combined River Ln / Lind St Signals | Combined River Ln / Lind St Roundabouts | Combined River Ln / Lind St RCUTs | TH 14 Interchange Full Cloverleaf and Webster Area Interchange | TH 14 Interchange Eliminate South Loop - Roundabout | TH 14 Interchange Eliminate South Loop - Signal | TH 14 Interchange Diverging Diamond | TH 14 Interchange Roundabout Ramp Intersections | TH 14 Interchange Signalize EB TH 14 Exit Ramp |
| AM | Northbound | Baseline | 3 | -40 | -3 | -69 | 34 | 14 | 28 | 45 | 2 |
| | Southbound | | 41 | 18 | -16 | -25 | 5 | 40 | 18 | 93 | 8 |
| PM | Northbound | | -12 | -49 | 20 | -81 | 40 | 17 | 24 | 51 | 0 |
| | Southbound | | 25 | 14 | 35 | -26 | 5 | 25 | 16 | 116 | 6 |
| ***Average Change in Travel Time*** | | *Baseline* | *15* | *-14* | *9* | *-50* | *21* | *24* | *22* | *76* | *4* |

The information shown in **Tables 7** and **8** indicate that Concepts 1a, 1c, 2b, 2c, 2d and 2f would minimally increase the average travel time for vehicles from the No Build scenario with the average travel time increasing by between 4 and 24 seconds. Concepts 1b and 1d/2a shows a decrease in travel time on average compared to the No Build scenario. For Concept 1b the northbound travel time shows an estimated 40 to 49 second reduction during the peak hours and the southbound travel time shows an estimated increase of only 14 to 18 seconds. For Concept 1d/2a the northbound travel time shows an estimated 25 to 26 second reduction and the southbound travel time shows an estimated 69 to 81 seconds reduction during the peak hours. Concept 2e, which analyzed roundabouts at the TH 14 ramp terminals shows the greatest increase in travel time with

an average increase in travel time of 76 seconds. The northbound travel time shows an estimated increase in travel time by 45 to 51 second during the peak hours and the southbound travel time shows an estimated increase of 93 to 116 seconds.

# Southern Subarea

The southern subarea runs from the Blue Earth River crossing to Highway 60 within South Bend Township. This is a four-lane divided expressway corridor. This area includes primarily low density residential, park, and open space land uses directly adjacent to Highway 169, with some areas of commercial and light industrial.

The southern subarea was broken down into three sections for the concept analysis. These sections are outlined below:

- Section 1 extends from the Blue Earth River crossing to CSAH 33
- Section 2 extends from CSAH 33 to CSAH 90
- Section 3 extends from CSAH 90 to 208th Ln

## Concepts

Throughout the southern subarea options were derived for each section. These options are described below:

- **Section 1 – Blue Earth River crossing through CSAH 33**
    - Concept 1A – RCUTs at Amos Owen Ln and CSAH 33
    - Concept 1B – Restrict access at Hawley St; RCUTs at Amos Owen Ln and CSAH 33
    - Concept 1C – Signalized Green T at Hawley St; restrict access at CSAH 33 and Amos Owen Ln
    - Concept 1D – Signalized Green T at CSAH 33; restrict access at Hawley St and Amos Owen Ln

- **Section 2 – CSAH 33 to CSAH 90**
    - Concept 2A – High-T at TH 68; restrict access at CR 120, CSAH 69, and businesses; close Bison St access
    - Concept 2B1 – High-T at TH 68; consolidate access near CSAH 69 to provide better access spacing; close Bison St access
    - Concept 2B2 – Right-In/Right-Out at TH 68; consolidate access between CR 120 and CSAH 69 to provide better access spacing; close Bison St access
    - Concept 2C – RCUTs at CR 120 and CSAH 69; add south leg to TH 68; close Bison St access
- **Section 3 – CSAH 90 to 208th Ln**
    - Concept 3A – RCUT at Gadwall Rd; restrict access at TH 60; close access at 208th Ln and Loren Dr
    - Concept 3B – Realign Gadwall Rd to provide better access spacing; close access at 208th Ln, Loren Dr, and CR 117

## Traffic Operations

A level of service (LOS) analysis of the 2040 peak hours was completed using the forecasted turning movement counts in Synchro/SimTraffic. Detailed traffic operations were not completed for Concept 2B1, 2C, or 3B as these concepts were kept at higher level and are anticipated to operate similar to either the other concepts analyzed or the existing conditions. The operations for the Southern Subarea concepts analyzed are shown in **Tables 9** through **11** below.

**Table 9. Section 1 Concepts – 2040 Build Traffic Operations**

| Concept | Intersection | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| 1A | CSAH 69 (Hawley St) at TH 169 | 26 | D | WBL | 189 | F | 1675 | 3 | A | WBL | 32 | D | 75 |
| | CSAH 33 at TH 169 | 5 | A | WBL | 33 | D | 300 | 10 | B | WBL | 119 | F | 450 |
| | CSAH 33 at TH 169 EB U-Turn | 2 | A | EBY | 26 | D | 50 | 3 | A | EBU | 21 | C | 75 |
| 1B (All WBL's from Hawley use U-Turn) | CSAH 69 (Hawley St) at TH 169 | 4 | A | EBR | 6 | A | 0 | 2 | A | EBR | 3 | A | 0 |
| | CSAH 33 at TH 169 | 6 | A | WBL | 44 | E | 350 | 16 | C | WBL | 214 | F | 650 |
| | CSAH 33 at TH 169 EB U-Turn | 3 | A | EBU | 34 | D | 75 | 4 | A | EBU | 24 | C | 75 |
| | CSAH 33 at TH 169 WB U-Turn | 8 | A | WBU | 77 | F | 600 | 4 | A | WBU | 247 | F | 125 |
| 1B (Half WBL's from Hawley use U-Turn, Half use CSAH 33) | CSAH 69 (Hawley St) at TH 169 | 3 | A | EBR | 4 | A | 0 | 2 | A | EBR | 3 | A | 0 |
| | CSAH 33 at TH 169 | 25 | D | WBL | 181 | F | 875 | 21 | C | WBL | 286 | F | 700 |
| | CSAH 33 at TH 169 EB U-Turn | 5 | A | EBU | 75 | F | 75 | 5 | A | EBU | 58 | F | 125 |
| | CSAH 33 at TH 169 WB U-Turn | 3 | A | WBU | 19 | C | 175 | 3 | A | WBU | 250 | F | 100 |
| 1C (WBL allowed at CSAH 33) | CSAH 69 (Hawley St) at TH 169 | 8 | A | NBL | 28 | C | 50 | 6 | A | WBL | 31 | C | 75 |
| | CSAH 33 at TH 169 | 6 | A | WBL | 44 | E | 375 | 36 | E | WBL | 444 | F | 1000 |
| 1C (All WBLs at Green-T) | CSAH 69 (Hawley St) at TH 169 | 16 | B | NBL | 36 | D | 50 | 11 | B | WBL | 34 | C | 250 |
| | CSAH 33 at TH 169 | 2 | A | EBT | 3 | A | 0 | 4 | A | EBT | 6 | A | 0 |
| 1D (All WBLs at Green-T) | CSAH 69 (Hawley St) at TH 169 | 2 | A | EBR | 5 | A | 0 | 4 | A | EBR | 7 | A | 0 |
| | CSAH 33 at TH 169 | 21 | C | WBL | 43 | D | 550 | 15 | B | WBL | 44 | D | 275 |

*Delay in seconds per vehicle.

**Table 9** shows the traffic operations for the Section 1 concepts. The Concept 1A operations indicate that the westbound left turn at Hawley St during the AM peak hour and at CSAH 33 during the PM peak hour operates with failing LOS (2-3 minutes of delay on average per vehicle). Additionally, the traffic queues for the westbound left at Hawley St during the AM peak hour are anticipated to extend 1675 ft. The channelized turn lane is only 350 ft so vehicles would block one of the through lanes along TH 169 with this option.

Concept 1B was analyzed two different ways. Concept 1B eliminates the westbound left turning movement at the intersection of Hawley St and TH 169 so the operations were analyzed first assuming all of the westbound lefts re-route via the U- turn along TH 169. Next Concept 1B was also analyzed assuming half of the westbound lefts re-route via the U- turn along TH 169 and the other half make the westbound left turn at CSAH 33. The operations for both options indicate that the westbound left and westbound U-turn are anticipated to operate with failing LOS and several longer queues during both peak hours.

Concept 1C was also analyzed two different ways. This concept proposes a signalized Green-T at Hawley St and eliminates the northbound left movement from CSAH 33 but keeps the westbound left turn at CSAH 33 open. The traffic operations indicate that if left open the westbound left at CSAH 33 would operate with failing LOS (over 7 minutes of delay per vehicle). Therefore, traffic operates were analyzed with CSAH 33 restricted to a right-in/right-out and all westbound left turners were re-routed via Hawley St. With all westbound lefts at Hawley St the operations are acceptable during both peak hours with the maximum movement delay of LOS D during the AM peak, LOS C during the PM peak, and minimal traffic queuing.

Concept 1D is similar to 1C, but proposes a signalized Green-T at CSAH 33 instead of Hawley St. With all westbound lefts assumed to occur at the CSAH 33 Green-T and Hawley St assumed to be restricted to right-in/right-out operations were found to be acceptable. The detailed 2040 traffic operations are included in **Tables A21** through **A32** of **Appendix C** and concept drawings of the concepts are included in **Appendix D**.

**Table 10. Section 2 Concepts – 2040 Build Traffic Operations**

| Concept | Intersection | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| 2A | TH 68 at TH 169 | 3 | A | SBL | 6 | A | 100 | 2 | A | SBL | 5 | A | 100 |
| 2B2 (Stop Controlled) | TH 68 at TH 169 | 2 | A | SBR | 7 | A | 75 | 3 | A | SBR | 7 | A | 50 |
| | CSAH 69 at TH 169 | 40 | E | SBL | 351 | F | 1025 | 106 | F | SBL | 1115 | F | 2075 |
| 2B2 (Stop Controlled, Acceleration Lane) | TH 68 at TH 169 | 3 | A | SBR | 10 | B | 75 | 2 | A | SBR | 7 | A | 50 |
| | CSAH 69 at TH 169 | 11 | B | SBL | 82 | F | 400 | 15 | C | SBL | 145 | F | 575 |
| 2B2 (Signalized) | TH 68 at TH 169 | 3 | A | SBR | 6 | A | 75 | 4 | A | EBT | 7 | A | 0 |
| | CSAH 69 at TH 169 | 11 | B | SBL | 47 | D | 300 | 11 | B | SBL | 47 | D | 275 |

*Delay in seconds per vehicle.

**Table 10** shows the traffic operations for the Section 2 Concepts. The operations for Concept 2A indicates that the High-T at the intersection of TH 68 and TH 169 operates well as a stop-controlled intersection with all movements operating with LOS A during both peak hours. Concept 2B2 analyzed the TH 68 at TH 169 intersection as a right-in/right-out and full access at the CSAH 69 and TH 169 intersection. Multiple traffic control options were analyzed for the intersection of CSAH 69 at TH 169. **Table 10** indicates that with stop control and no acceleration lanes the southbound left operates with excessive delay causing the peak hour overall to operate with LOS E during the AM peak hour and LOS F during the PM peak hour. An acceleration lane for the southbound left movement was also analyzed with stop control at the intersection of CSAH 69 and TH 169, however delay was still shown to be excessive for the southbound left turning movement. With a signal at CSAH 69 and TH 169 the operations are acceptable.

Although Concepts 2B1 and 2C were not modeled these options are anticipated to operate similar to Concepts 2A and 2B2. Concept 2B1 shows a High T at TH 68 and TH 169 which would operate similar to Concept 2A. Concept 2B1 also shows a full access intersection at CSAH 69 and TH 169 which would operate similar to Concept 2B2. Concept 2C shows a full access intersection at TH 68 and right-in/right-out at CSAH 69 which would operate similar to Concept 2B2.

The detailed 2040 traffic operations are included in **Tables A33** through **A40** of **Appendix C** and concept drawings of the concepts are included in **Appendix D**.

| Table 11. Section 3 Concepts – 2040 Build Traffic Operations | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Concept | Intersection | A.M. Peak Hour | | | | | | P.M. Peak Hour | | | | | |
| | | Intersection | | Maximum Movement | | | | Intersection | | Maximum Movement | | | |
| | | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) | Delay* | LOS | Mvmt | Delay* | LOS | Queue (ft) |
| 3A | TH 60 at TH 169 | 5 | A | WBL | 11 | B | 150 | 8 | A | WBL | 68 | F | 375 |
| | EB TH 169 U-Turn E of TH 60 | 5 | A | EBU | 12 | B | 50 | 4 | A | EBU | 23 | C | 75 |

*Delay in seconds per vehicle.

**Table 11** shows the traffic operations for Section 3 with an RCUT at Gadwall Rd and restricted access at TH 60 (no northbound left turn). This indicates that the intersections overall operate well with LOS A during both peak hours. The westbound left turn at TH 60 operates with LOS F during the PM peak hour, but delay is minimal during the AM peak hour. Although Concept 3B was not modeled, this option keeps TH 60 at TH 169 full access. If left as a full access intersection the northbound left turn is anticipated to operate with excessive delay during the PM peak hour as shown in the 2040 No Build operations.

The detailed 2040 traffic operations are included in **Tables A41** and **A42** of **Appendix C** and concept drawings of the concepts are included in **Appendix D**.

## Travel Time Analysis

A travel time analysis was also completed for the southern subarea concepts during the 2040 AM and PM peak hours along northbound and southbound TH 169 to see how each option increases or decreases the travel time for mainline vehicles compared to the No Build scenario. The travel time was reported along the southern subarea by section. The section 1 travel time was compared from Hawley St to CSAH 33, section 2 travel time was compared from CSAH 33 to CSAH 90, and section 3 travel time was compared from CSAH 90 to TH 60.

**Table 12** shows the travel time for the 2040 No Build scenario and each of the southern subarea options in section 1. **Table 13** shows the change in travel time compared to the No Build scenario.

| Table 12. Travel Time from Hawley St to CSAH 33 | | | | | | |
|---|---|---|---|---|---|---|
| Peak Hour | Direction | No Build - Section 1 | Highway 169 Concepts | | | |
| | | | 1a | 1b | 1c | 1d |
| | | | RCUTs at Amos Owen Ln and CSAH 33 | Restrict access at Hawley St; RCUTs at Amos Owen Ln and CSAH 33 | Signalized Green T at Hawley St; restrict access at CSAH 33 and Amos Owen Ln | Signalized Green T at CSAH 33; restrict access at Hawley St and Amos Owen Ln |
| AM | Northbound | 64 | 64 | 73 | 86 | 106 |
| | Southbound | 78 | 71 | 86 | 58 | 59 |
| PM | Northbound | 65 | 70 | 70 | 103 | 103 |
| | Southbound | 62 | 88 | 73 | 95 | 91 |

| Table 13. Change In Travel Time Compared to No Build from Hawley St to CSAH 33 | | | | | | |
|---|---|---|---|---|---|---|
| Peak Hour | Direction | No Build - Section 1 | Highway 169 Concepts | | | |
| | | | 1a | 1b | 1c | 1d |
| | | | RCUTs at Amos Owen Ln and CSAH 33 | Restrict access at Hawley St; RCUTs at Amos Owen Ln and CSAH 33 | Signalized Green T at Hawley St; restrict access at CSAH 33 and Amos Owen Ln | Signalized Green T at CSAH 33; restrict access at Hawley St and Amos Owen Ln |
| AM | Northbound | Baseline | 0 | 9 | 22 | 42 |
| | Southbound | | -8 | 8 | -20 | -19 |
| PM | Northbound | | 5 | 5 | 38 | 38 |
| | Southbound | | 25 | 10 | 32 | 29 |
| ***Average Change in Travel Time*** | | *Baseline* | 6 | 8 | 18 | 22 |

The information shown in **Tables 12** and **13** indicate that all of the concepts analyzed in section 1 of the southern subarea would minimally increase the average travel time for vehicles from the No Build scenario with the average travel time increasing by between 6 and 22 seconds.

**Table 14** shows the travel time for the 2040 No Build scenario and each of the southern subarea options in section 2. **Table 15** shows the change in travel time compared to the No Build scenario.

**Table 14. Travel Time from CSAH 33 to CSAH 90**

| Peak Hour | Direction | No Build - Section 2 | Highway 169 Concepts | | | |
|---|---|---|---|---|---|---|
| | | | 2a | 2b1 | 2b2 | 2c |
| | | | High-T at TH 68; restrict access at CR 120, CSAH 69, and businesses; close Bison St access | High-T at TH 68; consolidate access near CSAH 69; close Bison St access | RIRO at TH 68; consolidate access between CR 120 and CSAH 69; close Bison St access | RCUTs at CR 120 and CSAH 69; add south leg to TH 68; close Bison St access |
| AM | Northbound | 100 | 97 | N/A - did not model this concept | 105 | N/A - did not model this concept |
| | Southbound | 107 | 103 | | 116 | |
| PM | Northbound | 106 | 97 | | 114 | |
| | Southbound | 114 | 104 | | 122 | |

**Table 15. Change In Travel Time Compared to No Build from CSAH 33 to CSAH 90**

| Peak Hour | Direction | No Build - Section 2 | Highway 169 Concepts | | | |
|---|---|---|---|---|---|---|
| | | | 2a | 2b1 | 2b2 | 2c |
| | | | High-T at TH 68; restrict access at CR 120, CSAH 69, and businesses; close Bison St access | High-T at TH 68; consolidate access near CSAH 69; close Bison St access | RIRO at TH 68; consolidate access between CR 120 and CSAH 69; close Bison St access | RCUTs at CR 120 and CSAH 69; add south leg to TH 68; close Bison St access |
| AM | Northbound | Baseline | -3 | N/A - did not model this concept | 5 | N/A - did not model this concept |
| | Southbound | | -4 | | 9 | |
| PM | Northbound | | -9 | | 8 | |
| | Southbound | | -10 | | 8 | |
| ***Average Change in Travel Time*** | | *Baseline* | -7 | *N/A - did not model this concept* | 7 | *N/A - did not model this concept* |

The information shown in **Tables 14** and **15** indicate that Concept 2a is anticipated to decrease the travel time and Concept 2b2 is anticipated to minimally increase the travel time compared to the 2040 No Build scenario. Concept 2b1 and 2c were not modeled, however, due to the similarities in design to those modeled they are also estimated to minimally change the travel time from the 2040 No Build scenario.

**Table 16** shows the travel time for the 2040 No Build scenario and the southern subarea options in section 3. **Table 17** shows the change in travel time compared to the No Build scenario.

| Table 16. Travel Time from CSAH 33 to CSAH 90 | | | | |
|---|---|---|---|---|
| Peak Hour | Direction | No Build - Section 3 | Local System Concepts | |
| | | | 3a | 3b |
| | | | RCUT at Gadwall Rd; restrict access at TH 60; close access at 208th Ln and Loren Dr | Realign Gadwall Rd; close access at 208th Ln, Loren Dr, and CR 117 |
| AM | Northbound | 121 | 155 | N/A - did not model this concept |
| | Southbound | 121 | 153 | |
| PM | Northbound | 127 | 111 | |
| | Southbound | 115 | 110 | |

| Table 17. Change In Travel Time Compared to No Build | | | | |
|---|---|---|---|---|
| Peak Hour | Direction | No Build - Section 3 | Local System Concepts | |
| | | | 3a | 3b |
| | | | RCUT at Gadwall Rd; restrict access at TH 60; close access at 208th Ln and Loren Dr | Realign Gadwall Rd; close access at 208th Ln, Loren Dr, and CR 117 |
| AM | Northbound | Baseline | 34 | N/A - did not model this concept |
| | Southbound | | 31 | |
| PM | Northbound | | -16 | |
| | Southbound | | -5 | |
| ***Average Change in Travel Time*** | | *Baseline* | 11 | *N/A - did not model this concept* |

**Tables 16** and **17** indicate that Concept 3a is anticipated to minimally increase the travel time compared to the 2040 No Build scenario. Concept 3b was not modeled, however, it is anticipated to operate similarly to Concept 3a assuming mainline TH 169 has the priority at each intersection.

# Conclusion

This report summarizes the alterative traffic analysis of Highway 169 in the Northern Subarea from Lake St to the Veterans' Memorial Bridge and in the southern subarea from the Blue Earth River Crossing to Highway 60. Several concept designs were analyzed in both subareas. The concepts that operate acceptably are detailed below.

**Northern Subarea**

- Signals, roundabouts, or signalized RCUTs at a combined Lind St/River Ln and Webster Ave intersections were found to operate well.
- An interchange near Webster Ave that would combine Lind St, River Ln, and Webster Ave was found to operate well.
- At the TH 14/TH 169 interchange both a signalized intersection at the EB TH 14 ramps or a diverging diamond interchange were found to operate well.

**Southern Subarea**

- In Section 1 a signalized Green-T was found to operate well at either Hawley St or CSAH 33.
- In Section 2 both a High-T or a right-in/right-out were found to operate well at the TH 68 and TH 169 intersection.
- In Section 2 a full access intersection operates well if signalized.

- In Section 3 an RCUT at Gadwall Rd and restricting access at TH 60 was found to operate well.

The travel time analysis indicated that all concepts in the northern subarea except Concept 2e are anticipated to minimally change the travel time compared to the 2040 No Build scenario. In the southern subarea, all concepts were shown to have a minimal impact on travel time compared to the 2040 No Build scenario.

# Concept Evaluation Traffic Operations Memo
# Appendix A:
# Northern Subarea Detailed Traffic Operations

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Table A1: Northern Subarea - Concept 1 - Signalized Green-T - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBT | | SBT | | EBL | | EBR | |
| Hwy 169 & EB TH 14 Exit | AM | 12 | B | 0 | A | 9 | A | 45 | D | 23 | C |
| *Signalized Intersection* | PM | 9 | A | 1 | A | 7 | A | 49 | D | 26 | C |

1. Delay in seconds per vehicle

**Table A2: Northern Subarea - Concept 1 - Signalized Green-T - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBR | | NBT | | SBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & EB TH 14 Exit | AM | 150 | 300 | 150 | 325 | - | - | 125 | 325 |
| *Signalized Intersection* | PM | 150 | 300 | 100 | 275 | - | - | 150 | 325 |

**Table A3: Northern Subarea - Concept 2 - Access Relocation (Combined River Ln/Lind St) - Signalized Intersections - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | |
| Hwy 169 & Lind St/River Ln | AM | 33 | C | 39 | D | 30 | C | 18 | B | 75 | E | 29 | C | 7 | A | 43 | D | 43 | D | 14 | B | 50 | D | 63 | E | 52 | D |
| *Signalized Intersection* | PM | 32 | C | 56 | E | 25 | C | 15 | B | 96 | F | 23 | C | 7 | A | 50 | D | 52 | D | 18 | B | 66 | E | 57 | E | 62 | E |
| Hwy 169 & Webster Ave | AM | 28 | C | 61 | E | 19 | B | 6 | A | 72 | E | 30 | C | 19 | B | 49 | D | 50 | D | 21 | C | 36 | D | 37 | D | 12 | B |
| *Signalized Intersection* | PM | 30 | C | 75 | E | 22 | C | 6 | A | 79 | E | 27 | C | 19 | B | 55 | E | 67 | E | 27 | C | 38 | D | 36 | D | 16 | B |

1. Delay in seconds per vehicle

**Table A4: Northern Subarea - Concept 2 - Access Relocation (Combined River Ln/Lind St) - Signalized Intersections - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Lind St/River Ln | AM | 75 | 175 | 75 | 175 | 25 | 75 | 200 | 575 | 200 | 575 | 200 | 325 | 25 | 50 | 250 | 725 | 75 | 400 | 150 | 400 | 300 | 550 | 25 | 325 |
| *Signalized Intersection* | PM | 75 | 175 | 75 | 175 | 25 | 75 | 225 | 700 | 225 | 700 | 225 | 325 | 25 | 100 | 225 | 500 | 50 | 200 | 200 | 450 | 250 | 525 | 25 | 225 |
| Hwy 169 & Webster Ave | AM | 250 | 525 | 250 | 525 | 75 | 175 | 25 | 100 | 25 | 100 | 25 | 75 | 100 | 175 | 200 | 475 | 25 | 125 | 25 | 50 | 175 | 500 | 75 | 350 |
| *Signalized Intersection* | PM | 275 | 550 | 275 | 550 | 100 | 175 | 50 | 175 | 50 | 175 | 25 | 100 | 125 | 250 | 250 | 425 | 25 | 50 | 50 | 125 | 200 | 425 | 75 | 250 |

**Table A5: Northern Subarea - Concept 2 - Access Relocation (Combined River Ln/Lind St) - Roundabouts - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | |
| Hwy 169 & Lind St/River Ln | AM | 7 | A | 7 | A | 6 | A | 6 | A | 7 | A | 5 | A | 5 | A | 67 | F | 68 | F | 46 | E | 13 | B | 16 | C | 2 | A |
| *Roundabout* | PM | 8 | A | 9 | A | 8 | A | 8 | A | 10 | B | 6 | A | 6 | A | 56 | F | 59 | F | 37 | E | 19 | C | 14 | B | 2 | A |
| Hwy 169 & Webster Ave | AM | 11 | B | 16 | C | 11 | B | 11 | B | 5 | A | 4 | A | 5 | A | 34 | D | 6 | A | 16 | C | 68 | F | 40 | E | 41 | E |
| *Roundabout* | PM | 10 | B | 11 | B | 7 | A | 6 | A | 6 | A | 5 | A | 5 | A | 29 | D | 46 | E | 16 | C | 52 | F | 52 | F | 39 | E |

1. Delay in seconds per vehicle

**Table A6: Northern Subarea - Concept 2 - Access Relocation (Combined River Ln/Lind St) - Roundabouts - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Lind St/River Ln | AM | 50 | 250 | 50 | 250 | 50 | 250 | 25 | 100 | 25 | 100 | 0 | 0 | 25 | 325 | 25 | 325 | 25 | 325 | 25 | 250 | 25 | 250 | 25 | 250 |
| *Roundabout* | PM | 50 | 200 | 50 | 200 | 50 | 200 | 25 | 150 | 25 | 150 | 0 | 0 | 50 | 400 | 50 | 400 | 50 | 400 | 25 | 350 | 25 | 350 | 25 | 350 |
| Hwy 169 & Webster Ave | AM | 100 | 500 | 100 | 500 | 100 | 500 | 25 | 200 | 25 | 200 | 25 | 200 | 50 | 400 | 50 | 400 | 50 | 400 | 25 | 225 | 25 | 225 | 25 | 225 |
| *Roundabout* | PM | 100 | 600 | 100 | 600 | 100 | 600 | 25 | 225 | 25 | 225 | 25 | 225 | 50 | 350 | 50 | 350 | 50 | 350 | 25 | 275 | 25 | 275 | 25 | 275 |

**Table A7: Northern Subarea - Concept 2 - Access Relocation (Combined River Ln/Lind St) - Signalized RCUTs - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBU | | NBL | | NBT | | NBR | | SBU | | SBL | | SBT | | SBR | | EBR | | WBR | |
| Hwy 169 & Lind St/River Ln | AM | 17 | B | - | | 47 | D | 19 | B | 8 | A | - | | 45 | D | 9 | A | 3 | A | 16 | B | 35 | D |
| *Signalized Intersection* | PM | 30 | C | - | | 61 | E | 28 | C | 10 | B | - | | 76 | E | 21 | C | 6 | A | 22 | C | 67 | E |
| Hwy 169 & Webster Ave | AM | 12 | B | - | | 49 | D | 10 | B | 5 | A | - | | 45 | D | 7 | A | 5 | A | 27 | C | 16 | B |
| *Signalized Intersection* | PM | 17 | B | - | | 44 | D | 14 | B | 6 | A | - | | 43 | D | 19 | B | 11 | B | 21 | C | 17 | B |
| Hwy 169 & Lind/River North U-Turn | AM | 4 | A | 33 | C | - | | 4 | A | - | | - | | - | | 3 | A | - | | - | | - | |
| *Signalized Intersection* | PM | 4 | A | 32 | C | - | | 3 | A | - | | - | | - | | 2 | A | - | | - | | - | |
| Hwy 169 & Lind/River South U-Turn | AM | 5 | A | - | | - | | 2 | A | - | | 73 | E | - | | 4 | A | - | | - | | - | |
| *Signalized Intersection* | PM | 4 | A | - | | - | | 2 | A | - | | 63 | E | - | | 3 | A | - | | - | | - | |
| Hwy 169 & Webster North U-Turn | AM | 4 | A | 72 | E | - | | 5 | A | - | | - | | - | | 1 | A | - | | - | | - | |
| *Signalized Intersection* | PM | 4 | A | 74 | E | - | | 3 | A | - | | - | | - | | 1 | A | - | | - | | - | |
| Hwy 169 & Webster South U-Turn | AM | 10 | B | - | | - | | 10 | B | - | | 39 | D | - | | 4 | A | - | | - | | - | |
| *Signalized Intersection* | PM | 7 | A | - | | - | | 7 | A | - | | 27 | C | - | | 3 | A | - | | - | | - | |

1. Delay in seconds per vehicle

**Table A8: Northern Subarea - Concept 2 - Access Relocation (Combined River Ln/Lind St) - Signalized RCUTs - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBR | | WBR | | NBU | | NBL | | NBT | | NBR | | SBU | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Lind St/River Ln | AM | 50 | 150 | 200 | 525 | - | - | 25 | 50 | 175 | 475 | 75 | 250 | - | - | 100 | 250 | 100 | 275 | 25 | 150 |
| *Signalized Intersection* | PM | 50 | 225 | 350 | 650 | - | - | 25 | 75 | 375 | 750 | 100 | 500 | - | - | 200 | 500 | 275 | 675 | 50 | 400 |
| Hwy 169 & Webster Ave | AM | 175 | 375 | 25 | 125 | - | - | 75 | 150 | 125 | 275 | 25 | 50 | - | - | 25 | 75 | 75 | 200 | 50 | 100 |
| *Signalized Intersection* | PM | 150 | 325 | 50 | 125 | - | - | 100 | 175 | 150 | 350 | 25 | 50 | - | - | 25 | 100 | 200 | 400 | 100 | 175 |
| Hwy 169 & Lind/River North U-Turn | AM | - | - | - | - | 50 | 125 | - | - | 25 | 200 | - | - | - | - | - | - | 50 | 125 | - | - |
| *Signalized Intersection* | PM | - | - | - | - | 75 | 175 | - | - | - | - | - | - | - | - | - | - | 75 | 175 | - | - |
| Hwy 169 & Lind/River South U-Turn | AM | - | - | - | - | - | - | - | - | 50 | 175 | - | - | 100 | 200 | - | - | - | - | - | - |
| *Signalized Intersection* | PM | - | - | - | - | - | - | - | - | 50 | 175 | - | - | 100 | 150 | - | - | 25 | 100 | - | - |
| Hwy 169 & Webster North U-Turn | AM | - | - | - | - | 50 | 125 | - | - | 0 | 25 | - | - | - | - | - | - | 25 | 50 | - | - |
| *Signalized Intersection* | PM | - | - | - | - | 75 | 175 | - | - | 25 | 50 | - | - | - | - | - | - | 50 | 200 | - | - |
| Hwy 169 & Webster South U-Turn | AM | - | - | - | - | - | - | - | - | 100 | 225 | - | - | 175 | 300 | - | - | - | - | - | - |
| *Signalized Intersection* | PM | - | - | - | - | - | - | - | - | 125 | 225 | - | - | 175 | 300 | - | - | 25 | 75 | - | - |

**Table A9a: Northern Subarea - Concept 3 - Combined River Ln/Lind St/Webster Ave (At Grade Signal) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | |
| Hwy 169 & Lind St/River Ln/Webster Ave | AM | 41 | D | 69 | E | 36 | D | 11 | B | 68 | E | 32 | C | 9 | A | 96 | F | 40 | D | 23 | C | 63 | E | 49 | D | 42 | D |
| *Signalized Intersection* | PM | 45 | D | 62 | E | 53 | D | 15 | B | 69 | E | 37 | D | 13 | B | 75 | E | 33 | C | 18 | B | 90 | F | 57 | E | 34 | C |

1. Delay in seconds per vehicle

**Table A10a: Northern Subarea - Concept 3 - Combined River Ln/Lind St/Webster Ave (At Grade Signal) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Lind St/River Ln/Webster Ave | AM | 225 | 325 | 200 | 625 | 75 | 275 | 100 | 200 | 75 | 450 | 200 | 425 | 100 | 300 | 275 | 475 | 75 | 275 | 150 | 275 | 250 | 425 | 75 | 150 |
| *Signalized Intersection* | PM | 200 | 325 | 75 | 475 | 75 | 325 | 125 | 275 | 75 | 500 | 225 | 425 | 150 | 425 | 400 | 725 | 150 | 500 | 200 | 425 | 275 | 450 | 100 | 300 |

**Table A9b: Northern Subarea - Concept 3 - Combined River Ln/Lind St/Webster Ave (Interchange) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | |
| SB TH 169 Ramps | AM | 6 | A | - | | - | | - | | 6 | A | - | | 6 | A | - | | 8 | A | 6 | A | 4 | A | 5 | A | - | |
| *Roundabout* | PM | 11 | B | - | | - | | - | | 17 | C | - | | 17 | C | - | | 8 | A | 7 | A | 4 | A | 5 | A | - | |
| NB TH 169 Ramps | AM | 18 | C | 22 | C | - | | 21 | C | - | | - | | - | | 10 | B | 10 | A | - | | - | | 27 | D | 25 | D |
| *Roundabout* | PM | 10 | B | 8 | A | - | | 9 | A | - | | - | | - | | 6 | A | 7 | A | - | | - | | 18 | C | 15 | C |

1. Delay in seconds per vehicle

**Table A10b: Northern Subarea - Concept 3 - Combined River Ln/Lind St/Webster Ave (Interchange) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| SB TH 169 Ramps | AM | - | | 75 | 175 | 75 | 175 | 25 | 25 | 25 | 25 | - | | - | | - | | - | | 50 | 175 | - | | 50 | 175 |
| *Roundabout* | PM | - | | 75 | 200 | 75 | 200 | 25 | 75 | 25 | 75 | - | | - | | - | | - | | 125 | 325 | - | | 125 | 325 |
| NB TH 169 Ramps | AM | 75 | 275 | 75 | 275 | - | | - | | 150 | 500 | 150 | 500 | 125 | 375 | - | | 125 | 375 | - | | - | | - | |
| *Roundabout* | PM | 50 | 175 | 50 | 175 | - | | - | | 125 | 350 | 125 | 350 | 75 | 175 | - | | 75 | 175 | - | | - | | - | |

**Table A11: Northern Subarea - Concept 4 - Full Cloverleaf Interchange- 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | NBT | | NBR | | SBL | SBT | | SBR | | EBL | EBT | | EBR | | WBL | WBT | | WBR | |
| SB TH 169 at WB TH 14 Ent & NB TH 169 at WB TH 14 Exit | AM | 0 | A | - | 0 | A | - | | - | 0 | A | 1 | A | - | - | | - | | - | - | | 1 | A |
| *Stop Controlled* | PM | 0 | A | - | 0 | A | - | | - | 0 | A | 2 | A | - | - | | - | | - | - | | 0 | A |
| SB TH 169 at WB TH 14 Exit Ramp & NB TH 169 at WB TH 14 Ent | AM | 0 | A | - | 0 | A | 0 | A | - | 0 | A | - | | - | - | | 1 | A | - | - | | - | |
| *Stop Controlled* | PM | 1 | A | - | 0 | A | 0 | A | - | 0 | A | - | | - | - | | 1 | A | - | - | | - | |
| SB TH 169 at EB TH 14 Ent &NB TH 169 at EB TH 14 Exit | AM | 1 | A | - | 0 | A | - | | - | 1 | A | 1 | A | - | - | | - | | - | - | | 0 | A |
| *Stop Controlled* | PM | 1 | A | - | 0 | A | - | | - | 1 | A | 1 | A | - | - | | - | | - | - | | 0 | A |
| EB TH 14 Exit & Hwy 169 | AM | 0 | A | - | 0 | A | - | | - | 0 | A | - | | - | 0 | A | 1 | A | - | - | | - | |
| *Stop Controlled* | PM | 0 | A | - | 0 | A | - | | - | 0 | A | - | | - | 0 | A | 0 | A | - | - | | - | |
| NB TH 169 & EB TH 14 Ent | AM | 1 | A | - | 1 | A | 1 | A | - | 1 | A | - | | - | - | | - | | - | - | | - | |
| *Stop Controlled* | PM | 1 | A | - | 1 | A | 1 | A | - | 0 | A | - | | - | - | | - | | - | - | | - | |
| TH 14 & EB TH 14 Exit | AM | 2 | A | - | 4 | A | 3 | A | - | 0 | A | - | | - | - | | - | | - | - | | - | |
| *Stop Controlled* | PM | 2 | A | - | 5 | A | 4 | A | - | 0 | A | - | | - | - | | - | | - | - | | - | |
| TH 14 & WB TH 14 Ent | AM | 2 | A | - | - | | - | | - | - | | 6 | A | - | 1 | A | - | | - | - | | - | |
| *Stop Controlled* | PM | 2 | A | - | - | | - | | - | - | | 6 | A | - | 1 | A | - | | - | 3 | A | - | |
| TH 14 at WB TH 14 Exit (to SB TH 169) & TH 14 at EB TH 14 Ent (from SB TH 169) | AM | 1 | A | - | - | | 0 | A | - | - | | - | | - | 2 | A | - | | - | 1 | A | 1 | A |
| *Stop Controlled* | PM | 2 | A | - | - | | 0 | A | - | - | | - | | - | 2 | A | - | | - | 2 | A | 1 | A |
| TH 14 at WB TH 14 Ent (from NB TH 169) & TH 14 at EB TH 14 Exit (to NB TH 169) | AM | 1 | A | - | - | | - | | - | - | | 0 | A | - | 1 | A | 0 | A | - | 2 | A | - | |
| *Stop Controlled* | PM | 3 | A | - | - | | - | | - | - | | 0 | A | - | 1 | A | 0 | A | - | 4 | A | - | |
| TH 14 & WB TH 14 Exit | AM | 2 | A | - | 1 | A | 1 | A | - | - | | - | | - | 2 | A | - | | - | 1 | A | 1 | A |
| *Stop Controlled* | PM | 3 | A | - | 1 | A | 1 | A | - | - | | - | | - | 3 | A | - | | - | 4 | A | 1 | A |

1. Delay in seconds per vehicle

**Table A12: Northern Subarea - Concept 4 - Full Cloverleaf Interchange - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| SB TH 169 at WB TH 14 Ent & NB TH 169 at WB TH 14 Exit | AM | - | | - | | - | | - | | - | | 0 | 0 | - | | 0 | 0 | - | | - | | 0 | 0 | 0 | 0 |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | 0 | 0 | - | | 0 | 0 | - | | - | | 0 | 0 | 0 | 0 |
| SB TH 169 at WB TH 14 Exit Ramp & NB TH 169 at WB TH 14 Ent | AM | - | | - | | 0 | 0 | - | | - | | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | - | |
| *Stop Controlled* | PM | - | | - | | 0 | 0 | - | | - | | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | - | |
| SB TH 169 at EB TH 14 Ent &NB TH 169 at EB TH 14 Exit | AM | - | | - | | - | | - | | - | | 0 | 0 | - | | 0 | 0 | - | | - | | 0 | 0 | 0 | 0 |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | 0 | 0 | - | | 0 | 0 | - | | - | | 0 | 0 | 0 | 0 |
| EB TH 14 Exit & Hwy 169 | AM | - | | 0 | 0 | 0 | 0 | - | | - | | - | | - | | 0 | 0 | - | | - | | 0 | 0 | - | |
| *Stop Controlled* | PM | - | | 0 | 0 | 0 | 0 | - | | - | | - | | - | | 0 | 0 | - | | - | | 0 | 0 | - | |
| NB TH 169 & EB TH 14 Ent | AM | - | | - | | - | | - | | - | | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 25 | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | - | |
| TH 14 & EB TH 14 Exit | AM | - | | - | | - | | - | | - | | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 25 | - | |
| TH 14 & WB TH 14 Ent | AM | - | | 0 | 0 | - | | - | | 0 | 0 | - | | - | | - | | - | | - | | - | | 0 | 25 |
| *Stop Controlled* | PM | - | | 0 | 0 | - | | - | | 0 | 0 | - | | - | | - | | - | | - | | - | | 0 | 25 |
| TH 14 at WB TH 14 Exit (to SB TH 169) & TH 14 at EB TH 14 Ent (from SB TH 169) | AM | - | | 0 | 0 | - | | - | | 0 | 0 | 0 | 0 | - | | - | | 0 | 0 | - | | - | | - | |
| *Stop Controlled* | PM | - | | 0 | 0 | - | | - | | 0 | 0 | 0 | 0 | - | | - | | 0 | 0 | - | | - | | - | |
| TH 14 at WB TH 14 Ent (from NB TH 169) & TH 14 at EB TH 14 Exit (to NB TH 169) | AM | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | - | | - | | - | | - | | - | | - | | 0 | 0 |
| *Stop Controlled* | PM | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | - | | - | | - | | - | | - | | - | | 0 | 0 |
| TH 14 & WB TH 14 Exit | AM | - | | 0 | 25 | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | 0 | 25 | - | | - | | - | |
| *Stop Controlled* | PM | - | | 0 | 50 | - | | - | | 0 | 0 | 0 | 0 | - | | 0 | 0 | 0 | 0 | - | | - | | - | |

**Table A13a: Northern Subarea - Concept 4 - Eliminate South Loop (Roundabout) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBT | | NBR | | SBL | | SBT | | EBL | | EBR | |
| Hwy 169 & EB TH 14 Ramps | AM | 63 | F | 7 | A | 5 | A | 3 | A | 3 | A | 330 | F | 435 | F |
| *Roundabout* | PM | 45 | E | 10 | B | 4 | A | 4 | A | 4 | A | 371 | F | 444 | F |

1. Delay in seconds per vehicle

**Table A14a: Northern Subarea - Concept 4 - Eliminate South Loop (Roundabout) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBR | | NBT | | NBR | | SBL | | SBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & EB TH 14 Ramps | AM | 975 | 2225 | 2350 | 4900 | 25 | 350 | 25 | 250 | 0 | 50 | 0 | 50 |
| *Roundabout* | PM | 975 | 3075 | 1500 | 3225 | 50 | 325 | 25 | 200 | 0 | 125 | 0 | 125 |

**Table A13b: Northern Subarea - Concept 4 - Eliminate South Loop (Signal) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBT | | NBR | | SBL | | SBT | | EBL | | EBR | |
| Hwy 169 & EB TH 14 Ramps | AM | 19 | B | 18 | B | 13 | B | 60 | E | 10 | B | 47 | D | 26 | C |
| *Signalized Intersection* | PM | 22 | C | 27 | C | 18 | B | 61 | E | 8 | A | 57 | E | 24 | C |

1. Delay in seconds per vehicle

**Table A14b: Northern Subarea - Concept 4 - Eliminate South Loop (Signal) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBR | | NBT | | NBR | | SBL | | SBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & EB TH 14 Ramps | AM | 150 | 275 | 150 | 375 | 150 | 325 | 50 | 375 | 150 | 250 | 150 | 300 |
| *Signalized Intersection* | PM | 150 | 300 | 100 | 250 | 275 | 525 | 150 | 500 | 150 | 275 | 150 | 350 |

**Table A15a: Northern Subarea - Concept 4 - Diverging Diamond - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | |
| TH 169 Crossover (North) | AM | 8 | A | - | | 8 | A | - | | - | | 14 | B | 1 | A | - | | - | | - | | - | | - | | - | |
| *Signalized Intersection* | PM | 9 | A | - | | 5 | A | - | | - | | 15 | B | 0 | A | - | | - | | - | | - | | - | | - | |
| WBL TH 14 Exit Ramp at SB TH 169 | AM | 8 | A | - | | - | | - | | - | | 2 | A | - | | - | | - | | - | | 16 | B | - | | - | |
| *Signalized Intersection* | PM | 10 | B | - | | - | | - | | - | | 3 | A | - | | - | | - | | - | | 17 | B | - | | - | |
| TH 169 Crossover (South) | AM | 10 | B | - | | 13 | B | - | | - | | 8 | A | - | | - | | - | | - | | - | | - | | - | |
| *Signalized Intersection* | PM | 11 | B | - | | 14 | B | - | | - | | 9 | A | - | | - | | - | | - | | - | | - | | - | |
| EBL TH 14 Exit Ramp at NB TH 169 | AM | 5 | A | - | | 2 | A | - | | - | | - | | - | | 16 | B | - | | - | | - | | - | | - | |
| *Signalized Intersection* | PM | 4 | A | - | | 2 | A | - | | - | | - | | - | | 13 | B | - | | - | | - | | - | | - | |
| WBR TH 14 Exit Ramp at NB TH 169 | AM | 4 | A | - | | 1 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | 10 | B |
| *Stop Controlled* | PM | 4 | A | - | | 2 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | 12 | B |
| WB TH 14 Exit (WBL/WBR Split) | AM | 1 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | 1 | A | - | | 0 | A |
| *Stop Controlled* | PM | 4 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | 5 | A | - | | 1 | A |
| WB TH 14 Entrance (SBR/NBL Merge) | AM | 2 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | | 0 | A | 2 | A |
| *Stop Controlled* | PM | 1 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | | 0 | A | 1 | A |
| NB Hwy 169 at NBT/NBR Split | AM | 2 | A | - | | 2 | A | 3 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | 5 | A | - | | 7 | A | 3 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| EBR TH 14 Exit Ramp at SB TH 169 | AM | 4 | A | - | | - | | - | | - | | 2 | A | - | | - | | - | | 12 | B | - | | - | | - | |
| *Signalized Intersection* | PM | 3 | A | - | | - | | - | | - | | 2 | A | - | | - | | - | | 12 | B | - | | - | | - | |
| EB TH 14 Entrance (NBR/SBL Merge) | AM | 4 | A | - | | - | | - | | - | | - | | - | | - | | 1 | A | 4 | A | - | | - | | - | |
| *Stop Controlled* | PM | 3 | A | - | | - | | - | | - | | - | | - | | - | | 2 | A | 4 | A | - | | - | | - | |
| SB TH 169 at EB TH 14 Entrance Ramp | AM | 4 | A | - | | - | | - | | 3 | A | 4 | A | - | | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | 8 | A | - | | - | | - | | 8 | A | 8 | A | - | | - | | - | | - | | - | | - | | - | |
| NB TH 169 at WB TH 14 Entrance Ramp | AM | 2 | A | 3 | A | 1 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | 2 | A | 3 | A | 2 | A | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| EB TH 14 Exit (EBL/EBR Split) | AM | 1 | A | - | | - | | - | | - | | - | | - | | 1 | A | - | | 1 | A | - | | - | | - | |
| *Stop Controlled* | PM | 1 | A | - | | - | | - | | - | | - | | - | | 2 | A | - | | 1 | A | - | | - | | - | |

1. Delay in seconds per vehicle

**Table A16a: Northern Subarea - Concept 4 - Diverging Diamond - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| TH 169 Crossover (North) | AM | - | | - | | - | | - | | - | | - | | - | | 100 | 175 | - | | - | | 125 | 200 | 0 | 0 |
| *Signalized Intersection* | PM | - | | - | | - | | - | | - | | - | | - | | 50 | 150 | - | | - | | 150 | 225 | 0 | 0 |
| WBL TH 14 Exit Ramp at SB TH 169 | AM | - | | - | | - | | 125 | 200 | - | | - | | - | | - | | - | | - | | 0 | 25 | - | |
| *Signalized Intersection* | PM | - | | - | | - | | 175 | 225 | - | | - | | - | | - | | - | | - | | 0 | 25 | - | |
| TH 169 Crossover (South) | AM | - | | - | | - | | - | | - | | - | | - | | 150 | 175 | - | | - | | 125 | 125 | - | |
| *Signalized Intersection* | PM | - | | - | | - | | - | | - | | - | | - | | 175 | 200 | - | | - | | 125 | 150 | - | |
| EBL TH 14 Exit Ramp at NB TH 169 | AM | 100 | 175 | - | | - | | - | | - | | - | | - | | 0 | 25 | - | | - | | - | | - | |
| *Signalized Intersection* | PM | 75 | 150 | - | | - | | - | | - | | - | | - | | 0 | 25 | - | | - | | - | | - | |
| WBR TH 14 Exit Ramp at NB TH 169 | AM | - | | - | | - | | - | | - | | 75 | 150 | - | | 0 | 25 | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | 75 | 150 | - | | 0 | 25 | - | | - | | - | | - | |
| WB TH 14 Exit (WBL/WBR Split) | AM | - | | - | | - | | 25 | 75 | - | | 0 | 0 | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | | - | | 25 | 150 | - | | 0 | 0 | - | | - | | - | | - | | - | | - | |
| WB TH 14 Entrance (SBR/NBL Merge) | AM | - | | - | | - | | - | | 0 | 50 | 50 | 150 | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | 0 | 25 | 25 | 75 | - | | - | | - | | - | | - | | - | |
| NB Hwy 169 at NBT/NBR Split | AM | - | | - | | - | | - | | - | | - | | - | | 25 | 100 | 0 | 25 | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | - | | - | | 50 | 150 | 0 | 0 | - | | - | | - | |
| EBR TH 14 Exit Ramp at SB TH 169 | AM | - | | - | | 100 | 200 | - | | - | | - | | - | | - | | - | | - | | 0 | 25 | - | |
| *Signalized Intersection* | PM | - | | - | | 75 | 175 | - | | - | | - | | - | | - | | - | | - | | 0 | 25 | - | |
| EB TH 14 Entrance (NBR/SBL Merge) | AM | - | | 0 | 0 | 75 | 175 | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | 0 | 50 | 75 | 150 | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| SB TH 169 at EB TH 14 Entrance Ramp | AM | - | | - | | - | | - | | - | | - | | - | | - | | - | | 50 | 200 | 75 | 200 | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | - | | - | | - | | - | | 100 | 250 | 100 | 250 | - | |
| NB TH 169 at WB TH 14 Entrance Ramp | AM | - | | - | | - | | - | | - | | - | | 0 | 0 | 0 | 25 | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | | - | | - | | - | | - | | 0 | 25 | 0 | 25 | - | | - | | - | | - | |
| EB TH 14 Exit (EBL/EBR Split) | AM | 0 | 25 | - | | 0 | 25 | - | | - | | - | | - | | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | 0 | 0 | - | | 0 | 0 | - | | - | | - | | - | | - | | - | | - | | - | | - | |

**Table A15b: Northern Subarea - Concept 4 - Eliminate Both Loops (Roundabout) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBR | | WBL | | WBR | |
| Hwy 169 & WB TH 14 Ramps | AM | 17 | C | 8 | A | 3 | A | - | | - | | 24 | C | 25 | D | - | | - | | 25 | D | 21 | C |
| *Roundabout* | PM | 78 | F | 8 | A | 4 | A | - | | - | | 42 | E | 49 | E | - | | - | | 201 | F | 273 | F |
| Hwy 169 & EB TH 14 Ramps | AM | 22 | C | - | | 7 | A | 5 | A | 3 | A | 2 | A | - | | 84 | F | 123 | F | - | | - | |
| *Roundabout* | PM | 10 | B | - | | 9 | A | 4 | A | 4 | A | 3 | A | - | | 36 | E | 52 | F | - | | - | |

1. Delay in seconds per vehicle

**Table A16b: Northern Subarea - Concept 4 - Eliminate Both Loops (Roundabout) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBR | | WBL | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & WB TH 14 Ramps | AM | - | | - | | 50 | 425 | 25 | 250 | 25 | 150 | 25 | 150 | - | | - | | 75 | 475 | 75 | 475 |
| *Roundabout* | PM | - | | - | | 675 | 1600 | 625 | 1650 | 0 | 100 | 0 | 75 | - | | - | | 150 | 550 | 150 | 550 |
| Hwy 169 & EB TH 14 Ramps | AM | 50 | 575 | 525 | 1900 | - | | - | | - | | 25 | 350 | 25 | 250 | 0 | 125 | 0 | 125 | - | |
| *Roundabout* | PM | 25 | 200 | 75 | 450 | - | | - | | - | | 25 | 300 | 25 | 200 | 0 | 125 | 0 | 125 | - | |

**Table A17: Northern Subarea - Concept 4 - Signalize EB TH 14 Exit Ramp - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | WBT | WBR |
| Hwy 169 & EB TH 14 Ramps | AM | 12 | B | - | | 5 | A | - | | - | | 6 | A | - | | 46 | D | - | | 20 | C | - | - | - |
| *Signalized Intersection* | PM | 9 | A | - | | 4 | A | - | | - | | 5 | A | - | | 48 | D | - | | 19 | B | - | - | - |

1. Delay in seconds per vehicle

**Table A18: Northern Subarea - Concept 4 - Signalize EB TH 14 Exit Ramp - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & EB TH 14 Ramps | AM | 150 | 250 | - | - | 125 | 300 | - | - | - | - | - | - | - | - | 100 | 225 | - | - | - | - | 125 | 250 | - | - |
| *Signalized Intersection* | PM | 125 | 250 | - | - | 100 | 200 | - | - | - | - | - | - | - | - | 125 | 275 | - | - | - | - | 125 | 250 | - | - |

**Table A19: Detailed Vissim Analysis - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | |
| Hwy 169 & EB TH 14 Ramps | AM | 18 | B | - | | 20 | C | 4 | A | 66 | E | 10 | B | - | | 48 | D | - | | 32 | C | - | | - | | - | |
| *Signalized Intersection* | PM | 17 | B | - | | 18 | B | 5 | A | 62 | E | 7 | A | - | | 61 | E | - | | 37 | D | - | | - | | - | |
| Hwy 169 & Lind St/River Ln | AM | 8 | A | 7 | A | 5 | A | 6 | A | 12 | B | 8 | A | 8 | A | 45 | E | 40 | E | 31 | D | 15 | C | 19 | C | 2 | A |
| *Roundabout* | PM | 9 | A | 10 | B | 8 | A | 8 | A | 13 | B | 10 | B | 9 | A | 37 | E | 41 | E | 29 | D | 19 | C | 15 | C | 2 | A |
| Hwy 169 & Webster Ave | AM | 10 | B | 16 | C | 11 | B | 11 | B | 5 | A | 5 | A | 5 | A | 24 | C | 6 | A | 11 | B | 67 | F | 31 | D | 41 | E |
| *Roundabout* | PM | 10 | B | 11 | B | 7 | A | 6 | A | 7 | A | 6 | A | 6 | A | 26 | D | 33 | D | 13 | B | 42 | E | 39 | E | 27 | D |

1. Delay in seconds per vehicle

**Table A20: Detailed Vissim Analysis - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBL | | EBT | | EBR | | WBL | | WBT | | WBR | | NBL | | NBT | | NBR | | SBL | | SBT | | SBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & EB TH 14 Ramps | AM | 75 | 325 | - | - | 75 | 450 | - | - | - | - | - | - | - | - | 50 | 325 | 25 | 375 | 75 | 350 | 50 | 350 | - | - |
| *Signalized Intersection* | PM | 75 | 325 | - | - | 50 | 275 | - | - | - | - | - | - | - | - | 75 | 425 | 25 | 425 | 75 | 325 | 25 | 300 | - | - |
| Hwy 169 & Lind St/River Ln | AM | 25 | 225 | 25 | 225 | 25 | 225 | 25 | 125 | 25 | 125 | 0 | 0 | 25 | 300 | 25 | 300 | 25 | 300 | 25 | 425 | 25 | 425 | 25 | 425 |
| *Roundabout* | PM | 25 | 175 | 25 | 175 | 25 | 175 | 25 | 150 | 25 | 150 | 0 | 0 | 50 | 425 | 50 | 425 | 50 | 425 | 25 | 425 | 25 | 425 | 25 | 425 |
| Hwy 169 & Webster Ave | AM | 50 | 425 | 50 | 425 | 50 | 425 | 25 | 200 | 25 | 200 | 25 | 200 | 50 | 375 | 50 | 375 | 50 | 375 | 25 | 275 | 25 | 275 | 25 | 275 |
| *Roundabout* | PM | 75 | 550 | 75 | 550 | 75 | 550 | 25 | 200 | 25 | 200 | 25 | 200 | 50 | 325 | 50 | 325 | 50 | 325 | 25 | 300 | 25 | 300 | 25 | 300 |

# Concept Evaluation Traffic Operations Memo
# Appendix B:
# Northern Subarea Concept Drawings

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

100 0 100 200
scale 50 feet

W LIND CT

N RIVER DR

169

14

W LIND ST

HINIKER POND

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 3/4/2021

# US 169 CORRIDOR STUDY

US 14 SOUTH RAMP GREEN T

2:22:20 PM
3/4/2021
shotchkin
X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

INSET 1 - SOUTH RAMP ALTERNATIVE GEOMETRICS

200 0 200 400
scale 100 feet

MINNESOTA RIVER

W LIND CT

N RIVER LN

PAULEY CT

N RIVER DR

169

RANGE ST

W LIND ST

14

HINIKER POND

WEBSTER AVE

CROSS ST

RANGE ST

| | | |
|---|---|---|
| SEH<br>PHONE: (651)490-2000<br>3535 VADNAIS CENTER DR.<br>ST. PAUL, MN 55110 | SEH PROJECT NO. 154596<br>DATE: 7/29/2021 | **US 169 CORRIDOR STUDY**<br>**TRADITIONAL SIGNAL AT US 14 SOUTH RAMP, LIND/RIVER RELOCATION & WEBSTER** |

1:56:11 PM
7/29/2021
shotchkin
X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

1:53:42 PM
3/4/2021
shotchkin
X:\AE\B\B0LTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

150 0 150 300
scale 75 feet

MINNESOTA RIVER
N RIVER LN
PAULEY CT
W LIND CT
N RIVER DR
169
RANGE ST
W LIND ST
HINIKER POND
RANGE ST
CROSS ST
WEBSTER AVE

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 3/4/2021

# US 169 CORRIDOR STUDY

ROUNDABOUTS AT LIND/RIVER RELOCATION & WEBSTER

1:53:39 PM
3/4/2021
shotchkin

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

150 0 150 300
scale 75 feet

MINNESOTA RIVER
N RIVER LN
PAULEY CT
W LIND CT
N RIVER DR
169
RANGE ST
W LIND ST
HINIKER POND
WEBSTER AVE
CROSS ST
RANGE ST

X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 3/4/2021

# US 169 CORRIDOR STUDY

RCUT AT LIND/RIVER RELOCATION & WEBSTER

# LEGEND

WETLAND

PARCELS

200 0 600

scale feet

14

169

FULL INTERCHANGE NEAR WEBSTER

MINNESOTA RIVER

N RIVER LN

N RIVER DR

RANGE ST

1 MILE

CLOSE

CLOSE

CLOSE

CLOSE

CLOSE

CLOSE

W LIND CT

R 170'

R 170'

APPROX. FULL CLOVERLEAF INTERCHANGE

CROSS ST

BUTTERWORTH ST

W LIND ST

HINIKER POND

WEBSTER AVE

LAKE ST

LAKE ST NW

COVENTRY LN

SEH

PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 3/4/2021

# US 169 CORRIDOR STUDY

FUTURE FREEWAY CONDITION

2:11:31 PM

3/4/2021

shotchkin

X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

N

100 0 100 200
scale 50 feet

169

14

W LIND CT

N RIVER DR

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 3/4/2021

# US 169 CORRIDOR STUDY

DIVERGING DIAMOND INTERCHANGE

2:02:14 PM
3/4/2021
shotchkin
X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

169

14

W LIND CT

N RIVER DR

N

100 0 100 200
scale 50 feet

1:53:47 PM
3/4/2021
shotchkin
X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_fig1.dgn

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 3/4/2021

# US 169 CORRIDOR STUDY

ROUNDABOUT INTERCHANGE

# Concept Evaluation Traffic Operations Memo
# Appendix C:
# Southern Subarea Detailed Traffic Operations

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Table A21: Southern Subarea Section 1 - Concept 1A- 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBR | | EBU | | EBT | | EBR | | WBL | | WBT | |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 26 | D | 1 | A | - | | 2 | A | 3 | A | 189 | F | 16 | C |
| *Stop Controlled* | PM | 3 | A | 1 | A | - | | 2 | A | 3 | A | 32 | D | 4 | A |
| CSAH 33 & Hwy 169 | AM | 5 | A | 2 | A | - | | 3 | A | 1 | A | 33 | D | 1 | A |
| *Stop Controlled* | PM | 10 | B | 2 | A | - | | 4 | A | 1 | A | 119 | F | 2 | A |
| Hwy 169 & CSAH 33 EB U-Turn | AM | 2 | A | - | | 26 | D | 2 | A | - | | - | | 1 | A |
| *Stop Controlled* | PM | 3 | A | - | | 21 | C | 4 | A | - | | - | | 1 | A |

1. Delay in seconds per vehicle

**Table A22: Southern Subarea Section 1 - Concept 1A - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBU | | EBT | | EBR | | WBL | | WBT | | NBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| CSAH 69 (Hawley St) & Hwy 169 | AM | - | - | - | - | 25 | 75 | 325 | 1675 | 375 | 1675 | - | - |
| *Stop Controlled* | PM | - | - | - | - | 25 | 25 | 25 | 75 | - | - | - | - |
| CSAH 33 & Hwy 169 | AM | - | - | - | - | 0 | 25 | 125 | 300 | 25 | 75 | - | - |
| *Stop Controlled* | PM | - | - | - | - | 25 | 25 | 225 | 450 | 50 | 200 | - | - |
| Hwy 169 & CSAH 33 EB U-Turn | AM | 25 | 50 | - | - | - | - | - | - | - | - | - | - |
| *Stop Controlled* | PM | 50 | 75 | 25 | 200 | - | - | - | - | - | - | - | - |

**Table A23: Southern Subarea Section 1 - Concept 1B (All WBLs from Hawley use U-Turn) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBR | | EBU | | EBT | | EBR | | WBU | | WBL | | WBT | |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 4 | A | - | | - | | 3 | A | 6 | A | - | | - | | 4 | A |
| *Stop Controlled* | PM | 2 | A | - | | - | | 2 | A | 3 | A | - | | - | | 2 | A |
| CSAH 33 & Hwy 169 | AM | 6 | A | 2 | A | - | | 3 | A | 1 | A | - | | 44 | E | 1 | A |
| *Stop Controlled* | PM | 16 | C | 2 | A | - | | 4 | A | 1 | A | - | | 214 | F | 2 | A |
| Hwy 169 & CSAH 33 EB U-Turn | AM | 3 | A | - | | 34 | D | 5 | A | - | | - | | - | | 0 | A |
| *Stop Controlled* | PM | 4 | A | - | | 24 | C | 6 | A | - | | - | | - | | 0 | A |
| Hwy 169 & Hawley St WB U-Turn | AM | 8 | A | - | | - | | 1 | A | - | | 77 | F | - | | 2 | A |
| *Stop Controlled* | PM | 4 | A | - | | - | | 0 | A | - | | 247 | F | - | | 5 | A |

1. Delay in seconds per vehicle

**Table A24: Southern Subarea Section 1 - Concept 1B (All WBLs from Hawley use U-Turn) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Movement Delay (sec/veh) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NBR | | EBU | | EBT | | EBR | | WBU | | WBL | | WBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| CSAH 69 (Hawley St) & Hwy 169 | AM | - | | - | - | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | - | - | | - | | - | | - | | - | |
| CSAH 33 & Hwy 169 | AM | - | | - | - | - | | 0 | 25 | - | | 150 | 350 | 25 | 100 |
| *Stop Controlled* | PM | - | | - | - | - | | 25 | 50 | - | | 350 | 650 | 150 | 525 |
| Hwy 169 & CSAH 33 EB U-Turn | AM | - | | 25 | 75 | - | | - | | - | | - | | - | - |
| *Stop Controlled* | PM | - | | 50 | 75 | - | | - | | - | | - | | 0 | 25 |
| Hwy 169 & Hawley St WB U-Turn | AM | - | | - | - | 25 | 50 | - | | 200 | 600 | - | | 25 | 350 |
| *Stop Controlled* | PM | - | | - | - | - | - | - | | 50 | 125 | - | | - | - |

**Table A25: Southern Subarea Section 1 - Concept 1B (Half WBLs from Hawley use U-Turn, Half use CSAH 33) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBR | | EBU | | EBT | | EBR | | WBU | | WBL | | WBT | |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 3 | A | - | | - | | 2 | A | 4 | A | - | | - | | 4 | A |
| *Stop Controlled* | PM | 2 | A | - | | - | | 2 | A | 3 | A | - | | - | | 2 | A |
| CSAH 33 & Hwy 169 | AM | 25 | D | 2 | A | - | | 4 | A | 1 | A | - | | 181 | F | 3 | A |
| *Stop Controlled* | PM | 21 | C | 3 | A | - | | 5 | A | 2 | A | - | | 286 | F | 3 | A |
| Hwy 169 & CSAH 33 EB U-Turn | AM | 5 | A | - | | 75 | F | 5 | A | - | | - | | - | | 4 | A |
| *Stop Controlled* | PM | 5 | A | - | | 58 | F | 6 | A | - | | - | | - | | 2 | A |
| Hwy 169 & Hawley St WB U-Turn | AM | 3 | A | - | | - | | 1 | A | - | | 19 | C | - | | 4 | A |
| *Stop Controlled* | PM | 4 | A | - | | - | | 0 | A | - | | 250 | F | - | | 6 | A |

1. Delay in seconds per vehicle

**Table A26: Southern Subarea Section 1 - Concept 1B (Half WBLs from Hawley use U-Turn, Half use CSAH 33) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Movement Delay (sec/veh) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NBR | | EBU | | EBT | | EBR | | WBU | | WBL | | WBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| CSAH 69 (Hawley St) & Hwy 169 | AM | - | | - | - | - | | - | | - | | - | | - | |
| *Stop Controlled* | PM | - | | - | - | - | | - | | - | | - | | - | |
| CSAH 33 & Hwy 169 | AM | - | | - | - | - | | - | | - | | 500 | 875 | 300 | 875 |
| *Stop Controlled* | PM | - | | - | - | - | | - | | - | | 450 | 700 | 275 | 700 |
| Hwy 169 & CSAH 33 EB U-Turn | AM | - | | 25 | 75 | - | | - | | - | | - | | 50 | 150 |
| *Stop Controlled* | PM | - | | 50 | 125 | - | | - | | - | | - | | 25 | 75 |
| Hwy 169 & Hawley St WB U-Turn | AM | - | | - | - | 25 | 50 | - | | 75 | 175 | - | | 50 | 175 |
| *Stop Controlled* | PM | - | | - | - | - | - | - | | 50 | 100 | - | | - | - |

**Table A27: Southern Subarea Section 1 - Concept 1C (WBL allowed at CSAH 33) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBR | | EBT | | EBR | | WBL | | WBT | |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 8 | A | 28 | C | 1 | A | 13 | B | 7 | A | 27 | C | 2 | A |
| *Signalized Intersection* | PM | 6 | A | 22 | C | 2 | A | 8 | A | 4 | A | 31 | C | 5 | A |
| CSAH 33 & Hwy 169 | AM | 6 | A | - | | 2 | A | 3 | A | 1 | A | 44 | E | 1 | A |
| *Stop Controlled* | PM | 36 | E | - | | 1 | A | 6 | A | 2 | A | 444 | F | 5 | A |

1. Delay in seconds per vehicle

**Table A28: Southern Subarea Section 1 - Concept 1C (WBL allowed at CSAH 33) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NBL | | NBR | | EBT | | EBR | | WBL | | WBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 25 | 50 | - | - | 125 | 250 | 75 | 175 | 125 | 250 | - | - |
| *Signalized Intersection* | PM | 25 | 75 | - | - | 100 | 200 | 50 | 100 | 25 | 75 | - | - |
| CSAH 33 & Hwy 169 | AM | - | - | - | - | - | - | 0 | 25 | 150 | 375 | 25 | 100 |
| *Stop Controlled* | PM | - | - | - | - | 0 | 25 | 0 | 25 | 575 | 1000 | 475 | 1000 |

**Table A29: Southern Subarea Section 1 - Concept 1C (All WBLs at Green-T) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBR | | EBT | | EBR | | WBL | | WBT | |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 16 | b | 36 | D | 1 | A | 24 | C | 15 | B | 34 | C | 2 | A |
| *Signalized Intersection* | PM | 11 | B | 33 | C | 2 | A | 15 | B | 7 | A | 34 | C | 6 | A |
| CSAH 33 & Hwy 169 | AM | 2 | A | - | | 2 | A | 3 | A | 1 | A | - | | 1 | A |
| *Stop Controlled* | PM | 4 | A | - | | 1 | A | 6 | A | 2 | A | - | | 2 | A |

1. Delay in seconds per vehicle

**Table A30: Southern Subarea Section 1 - Concept 1C (All WBLs at Green-T) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NBL | | NBR | | EBT | | EBR | | WBL | | WBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 25 | 50 | - | - | 200 | 400 | 100 | 300 | 250 | 450 | 25 | 175 |
| *Signalized Intersection* | PM | 25 | 100 | - | - | 175 | 325 | 75 | 150 | 125 | 250 | - | - |
| CSAH 33 & Hwy 169 | AM | - | - | - | - | - | - | - | - | - | - | - | - |
| *Stop Controlled* | PM | - | - | - | - | - | - | - | - | - | - | - | - |

**Table A31: Section 1 - Alternative 1D (All WBLs at Green-T) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | | NBR | | EBT | | EBR | | WBL | | WBT | |
| CSAH 69 (Hawley St) & Hwy 169 | AM | 2 | A | - | | 1 | A | 3 | A | 5 | A | - | | 2 | A |
| *Stop Controlled* | PM | 4 | A | - | | 1 | A | 5 | A | 7 | A | - | | 4 | A |
| CSAH 33 & Hwy 169 | AM | 21 | C | 39 | D | 2 | A | 37 | D | 14 | B | 43 | D | 1 | A |
| *Signalized Intersection* | PM | 15 | B | 40 | D | 2 | A | 24 | C | 7 | A | 44 | D | 2 | A |

1. Delay in seconds per vehicle

**Table A32: Section 1 - Alternative 1D (All WBLs at Green-T) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NBL | | NBR | | EBT | | EBR | | WBL | | WBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| CSAH 69 (Hawley St) & Hwy 169 | AM | - | - | - | - | - | - | - | - | - | - | - | - |
| *Stop Controlled* | PM | - | - | - | - | - | - | - | - | - | - | - | - |
| CSAH 33 & Hwy 169 | AM | 25 | 50 | - | - | 250 | 500 | 25 | 150 | 300 | 550 | 25 | 150 |
| *Signalized Intersection* | PM | 50 | 125 | - | - | 225 | 375 | 25 | 50 | 150 | 275 | - | - |

**Table A33: Southern Subarea Section 2 - Concept 2A - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | SBL | | EBL | | EBT | |
| Hwy 68 & Hwy 169 | AM | 3 | A | 6 | A | 2 | A | 2 | A |
| *Stop Controlled* | PM | 2 | A | 5 | A | 1 | A | 1 | A |

1. Delay in seconds per vehicle

**Table A34: Southern Subarea Section 2 - Concept 2A - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Queue Lengths (ft) | | | | | |
|---|---|---|---|---|---|---|---|
| | | SBL | | EBL | | EBT | |
| | | Avg | Max | Avg | Max | Avg | Max |
| Hwy 68 & Hwy 169 | AM | 50 | 100 | - | - | - | - |
| *Stop Controlled* | PM | 50 | 100 | - | - | - | - |

**Table A35: Southern Subarea Section 2 - Concept 2B2 (Stop Controlled) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SBL | | SBR | | EBL | | EBT | | WBT | | WBR | |
| Hwy 169 & Hwy 68 | AM | 2 | A | - | | 7 | A | - | | 3 | A | 1 | A | 0 | A |
| *Stop Controlled* | PM | 3 | A | - | | 7 | A | - | | 4 | A | 1 | A | 1 | A |
| Hwy 169 & CSAH 69 (Gadwall Rd) | AM | 40 | E | 351 | F | 160 | F | 11 | B | 3 | A | 3 | A | 2 | A |
| *Stop Controlled* | PM | 106 | F | 1115 | F | 1014 | F | 12 | B | 3 | A | 3 | A | 2 | A |

1. Delay in seconds per vehicle

**Table A36: Southern Subarea Section 2 - Concept 2B2 (Stop Controlled) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SBL | | SBR | | EBL | | EBT | | WBT | | WBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Hwy 68 | AM | - | - | 25 | 75 | - | - | - | - | - | - | - | - |
| *Stop Controlled* | PM | - | - | 25 | 50 | - | - | - | - | - | - | - | - |
| Hwy 169 & CSAH 69 (Gadwall Rd) | AM | 525 | 1025 | 50 | 325 | 25 | 50 | - | - | - | - | - | - |
| *Stop Controlled* | PM | 1625 | 2075 | 75 | 400 | 25 | 75 | - | - | - | - | 0 | 25 |

**Table A37: Southern Subarea Section 2 - Concept 2B2 (Stop Controlled, Acceleration Lane) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SBL | | SBR | | EBL | | EBT | | WBT | | WBR | |
| Hwy 169 & Hwy 68 | AM | 3 | A | - | | 10 | B | - | | 2 | A | 4 | A | 0 | A |
| *Stop Controlled* | PM | 2 | A | - | | 7 | A | - | | 3 | A | 1 | A | 1 | A |
| Hwy 169 & CSAH 69 (Gadwall Rd) | AM | 11 | B | 82 | F | 11 | B | 12 | B | 5 | A | 1 | A | 1 | A |
| *Stop Controlled* | PM | 15 | C | 145 | F | 25 | D | 14 | B | 3 | A | 1 | A | 0 | A |

1. Delay in seconds per vehicle

**Table A38: Southern Subarea Section 2 - Concept 2B2 (Stop Controlled, Acceleration Lane) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SBL | | SBR | | EBL | | EBT | | WBT | | WBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & TH 68 | AM | - | - | 25 | 75 | - | - | - | - | - | - | - | - |
| *Stop Controlled* | PM | - | - | 25 | 50 | - | - | - | - | - | - | - | - |
| Hwy 169 & CSAH 69 (Gadwall Rd) | AM | 175 | 400 | 25 | 175 | 25 | 50 | - | - | - | - | - | - |
| *Stop Controlled* | PM | 275 | 575 | 25 | 400 | 25 | 75 | - | - | - | - | - | - |

**Table A39: Southern Subarea Section 2 - Concept 2B2 (Signalized) - 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SBL | | SBR | | EBL | | EBT | | WBT | | WBR | |
| Hwy 169 & Hwy 68 | AM | 3 | A | - | | 6 | A | - | | 4 | A | 1 | A | 0 | A |
| *Stop Controlled* | PM | 4 | A | - | | 6 | A | - | | 7 | A | 1 | A | 1 | A |
| Hwy 169 & CSAH 69 (Gadwall Rd) | AM | 11 | B | 47 | D | 11 | B | 25 | C | 6 | A | 7 | A | 3 | A |
| *Signalized Intersection* | PM | 11 | B | 47 | D | 8 | A | 25 | C | 7 | A | 7 | A | 4 | A |

1. Delay in seconds per vehicle

**Table A40: Southern Subarea Section 2 - Concept 2B2 (Signalized) - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SBL | | SBR | | EBL | | EBT | | WBT | | WBR | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Hwy 68 | AM | - | - | 25 | 75 | - | - | - | - | - | - | - | - |
| *Stop Controlled* | PM | - | - | 25 | 50 | - | - | - | - | - | - | - | - |
| Hwy 169 & CSAH 69 (Gadwall Rd) | AM | 150 | 300 | 25 | 50 | 25 | 50 | 50 | 200 | 75 | 200 | 25 | 50 |
| *Signalized Intersection* | PM | 150 | 275 | 25 | 25 | 25 | 75 | 75 | 225 | 75 | 200 | 25 | 50 |

**Table A41: Southern Subarea Section 3 - Concept 3A- 2040 Traffic Operations Analysis**

| Intersection | Peak Hour | Intersection Delay (1.) | | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NBR | | EBU | | EBT | | EBR | | WBL | | WBT | |
| Hwy 169 & Hwy 60 | AM | 5 | A | 2 | A | - | | 2 | A | 2 | A | 11 | B | 7 | A |
| *Stop Controlled* | PM | 8 | A | 2 | A | - | | 3 | A | 5 | A | 68 | F | 3 | A |
| Hwy 169 EBU-Turn East of Hwy 60 | AM | 5 | A | - | | 12 | B | 7 | A | - | | - | | 4 | A |
| *Stop Controlled* | PM | 4 | A | - | | 23 | C | 5 | A | - | | - | | 3 | A |

1. Delay in seconds per vehicle

**Table A42: Southern Subarea Section 3 - Concept 3A - 2040 Peak Hour Queues By Movement**

| Intersection | Peak Hour | Movement Delay (sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NBR | | EBU | | EBT | | EBR | | WBL | | WBT | |
| | | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max | Avg | Max |
| Hwy 169 & Hwy 60 | AM | - | - | - | - | - | - | - | - | 50 | 150 | - | - |
| *Stop Controlled* | PM | - | - | - | - | - | - | - | - | 150 | 375 | 25 | 75 |
| Hwy 169 EBU-Turn East of Hwy 60 | AM | - | - | 25 | 50 | 0 | 25 | - | - | - | - | - | - |
| *Stop Controlled* | PM | - | - | 25 | 75 | - | - | - | - | - | - | - | - |

# Concept Evaluation Traffic Operations Memo
# Appendix D:
# Southern Subarea Concept Drawings

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

TH 169 - Southern Sub Area
Segment 1
Access Alternative 1A

U-turn area options if sight lines are a concern

Could move to align with 33 (Hemlock)

0.70 mi to Hwy 68

Consider elimination in conjunction with new access south of Hwy 68

Restricted Crossing

Same as existing (Does not allow NB to WB movement)

Hwy 169

Blue Earth River

N

400

SCALE IN FEET

BOLTON & MENK

HWY 169 CORRIDOR STUDY

H:\MAPO_MU\T61120619\CAD\MS\Prelim\Figures\Concept Geo_South_Seg 1_Figure 1.dgn
6:21:34 PM
2/1/2021
bml.tbl
pdf-B and W.pltcfg
michaelna

# TH 169 - Southern Sub Area
# Segment 1
# Access Alternative 1B

U-turn area options if sight lines are a concern

Could move to align with 33 (Hemlock)

0.70 mi to Hwy 68

Restricted Crossing

Eliminate Entering Hwy 169 at this location

Consider elimination in conjunction with new access south of Hwy 68

Hwy 169

Blue Earth River

N

400

SCALE IN FEET

BOLTON & MENK

HWY 169 CORRIDOR STUDY

H:\MAPO_MU\T61120619\CAD\MS\Prelim\Figures\Concept Geo_South_Seg 1_Figure 1.dgn
6:21:34 PM
2/1/2021
bml.tbl
pdf-B and W.pltcfg
michaelna

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

N

200 0 200 400
scale 100 feet

MINNESOTA RIVER
AMOS OWEN LN
MCCAULEY ST
BLUE EARTH RIVER
169
CHAPMAN ST
HAWLEY ST
SOUTHBEND AVE
CSAH 33

INSET 1 - ALTERNATIVE GEOMETRICS

SOUTHBEND AVE
CSAH 33

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 6/1/2021

# US 169 CORRIDOR STUDY
# SOUTH SUBAREA – SECTION 1

GREEN T AT HAWLEY ST

**FIGURE No. # 1**

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

N

scale 100 0 200 400 feet

MINNESOTA RIVER

BLUE EARTH RIVER

AMOS OWEN LN

MCCAULEY ST

CHAPMAN ST

HAWLEY ST

169

SOUTHBEND AVE

CSAH 33

INSET 2 - ALTERNATIVE GEOMETRICS

AMOS OWEN LN

MCCAULEY ST

CHAPMAN ST

SEH

PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

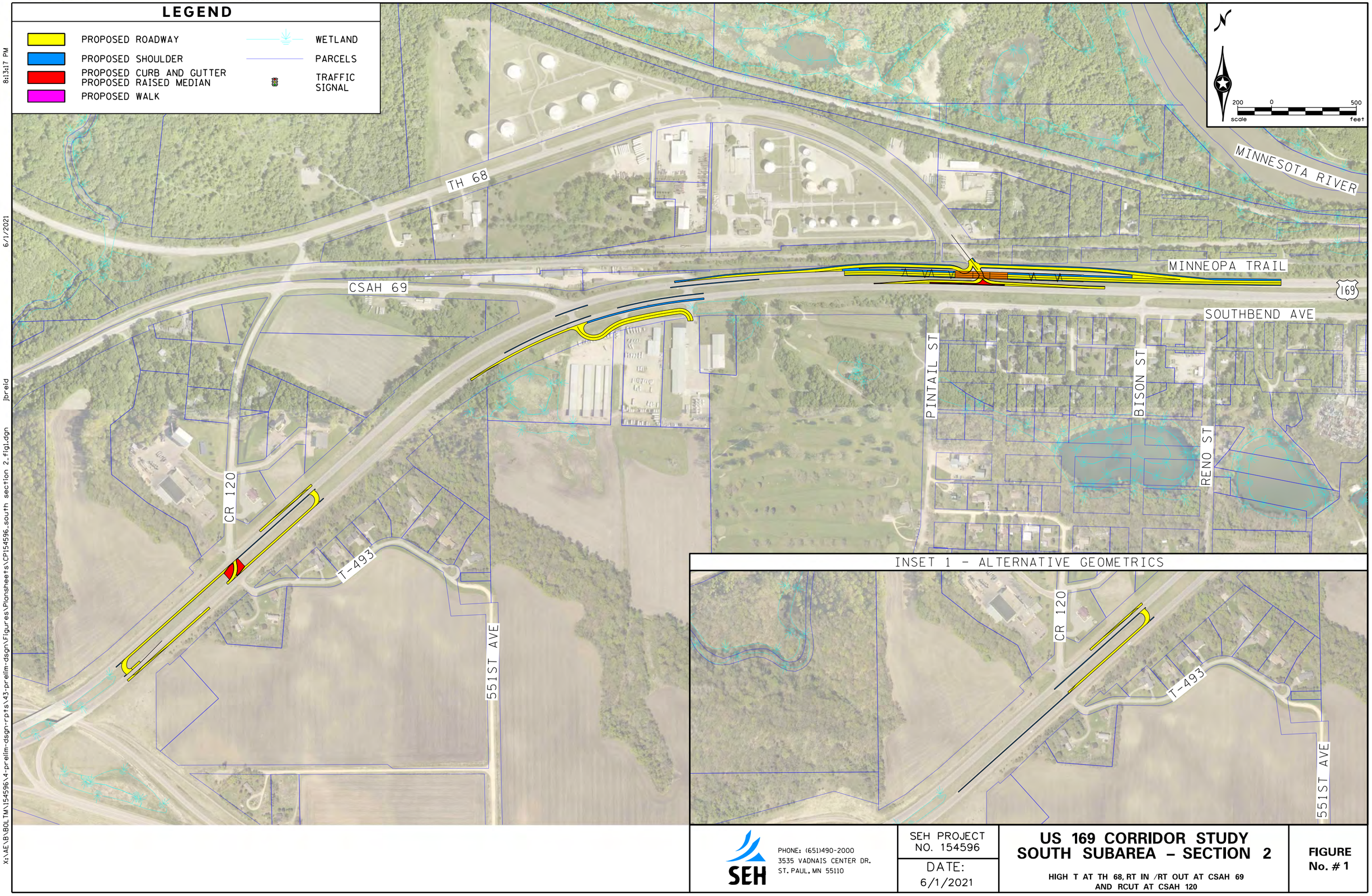
SEH PROJECT NO. 154596

DATE: 6/1/2021

# US 169 CORRIDOR STUDY SOUTH SUBAREA – SECTION 1

GREEN T AT CSAH 33
AND MUT AT AMOS OWEN LN

**FIGURE No. # 2**




SEH

PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 6/1/2021

**US 169 CORRIDOR STUDY**
**SOUTH SUBAREA – SECTION 2**

HIGH T AT TH 68, RT IN /RT OUT AT CSAH 69
AND RCUT AT CSAH 120

**FIGURE No. # 1**

8:13:17 PM 6/1/2021 jbreid

X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_south section 2.fig1.dgn

# TH 169 - Southern Sub Area
# Segment 2
# Access Alternative 2B1

Full Access Intersection

Hwy 68

Potential "High T" Candidate (Raise WB)

500
SCALE IN FEET

Hwy 69

Hwy 120

Property Impacts

Hwy 169

0.50 mi

Potentially Right-In Right-Out only

0.70 mi

Hwy 90

- Combines two partial accesses to one full access
- Multiple new connector roads

BOLTON & MENK

HWY 169 CORRIDOR STUDY

H:\MAPO_MU\T61\120619\CAD\MS\Prelim\Figures\Concept Geo_South_Seg 2_Figure 1.dgn
6:38:44 PM
2/1/2021
pdf-B and W.pltcfg bml.tbl
michaelma

# TH 169 - Southern Sub Area
# Segment 2
# Access Alternative 2B2

Full Access Intersection

Inset

Inset

Hwy 68

Right-in/Right-out

500

SCALE IN FEET

Hwy 169

Hwy 69

Hwy 120

0.65 mi

Property Impacts

Property Impacts

0.50 mi

Hwy 90

- Combines two partial accesses to one full access
- Multiple new connector roads

BOLTON & MENK

HWY 169 CORRIDOR STUDY

H:\MAPD_MU\T611120619\CAD\MS\Prelim\Figures\Concept Geo_South_Seg 2_Figure 1.dgn
2/1/2021 6:38:44 PM
michaeina
pdf-B and W.pltcfg bml.tbl

# TH 169 - Southern Sub Area
# Segment 2
# Access Alternative 2C

Full Access Intersection

Hwy 68

Existing Pedestrian Bridge

Hwy 169

Hwy 69

Must use RCUT on Hwy 69 to head EB

Hwy 120

Left turns not allowed (EB on 169 should turn left on 120)

Full Access Intersection could be implemented with closure at Hemlock Rd

SBL not allowed (poor skew angle)

Potentially utilize U Turn area in this location

Hwy 90

Typical RCUT
TH 212 at TH 284, Cologne

- Utilizes RCUTs to reduce crossing manuevers
- limits some direction of travel

500
SCALE IN FEET

BOLTON & MENK

HWY 169 CORRIDOR STUDY

## LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED CURB AND GUTTER
- PROPOSED RAISED MEDIAN
- PROPOSED WALK
- WETLAND
- PARCELS
- TRAFFIC SIGNAL

N

200 0 200 400
scale 100 feet

208TH LN

GADWALL RD

TH 60

169

LOREN DR

207TH MILITARY RD

169

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

SEH PROJECT NO. 154596

DATE: 6/1/2021

# US 169 CORRIDOR STUDY
# SOUTH SUBAREA – SECTION 3

RCUT AT US 169 ALONG WITH LOCAL ACCESS CONSOLIDATION

FIGURE No. # 1

7:54:12 PM
6/1/2021
jbreid
X:\AE\B\BOLTM\154596\4-prelim-dsgn-rpts\43-prelim-dsgn\Figures\Plansheets\CP154596_south section 3_fig1.dgn

# TH 169 - Southern Sub Area
# Segment 3
# Access Alternative 3B

Full Access Intersection

Property Impacts

0.50 mi

Property Impacts

1.20 mi

Cul-de-sac

- Better Spacing
- More Road Construction/Property Impacts

N

700

SCALE IN FEET

BOLTON & MENK

HWY 169 CORRIDOR STUDY

H:\MAPO_MU\T61120619\CAD\MS\Prelim\Figures\Concept Geo_South_Seg 3_Figure 1.dgn
6:45:34 PM
2/1/2021
pdf-B and W.pltcfg
bml.tbl
michaelna

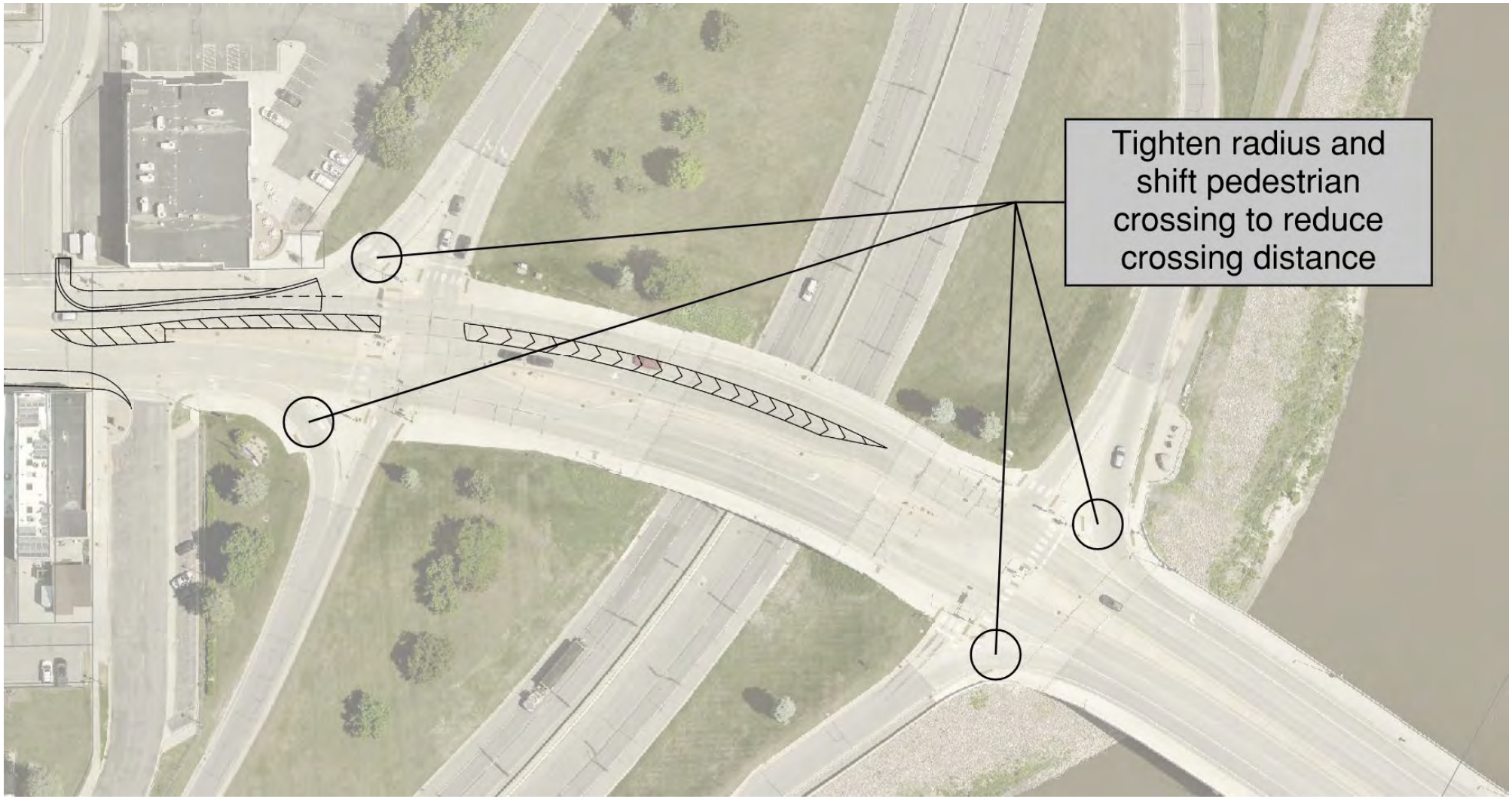
# Evaluation Memo Appendix C

MIDDLE SUBAREA CONCEPTS

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

**Middle Subarea Concepts**

Belgrade Avenue – Westbound Lane Reduction and Pedestrian Crossing Improvements




**Pros:**
- Improves pedestrian crossings
- Traffic operates well
- Improves traffic flow into potential reduced section west of Highway 169

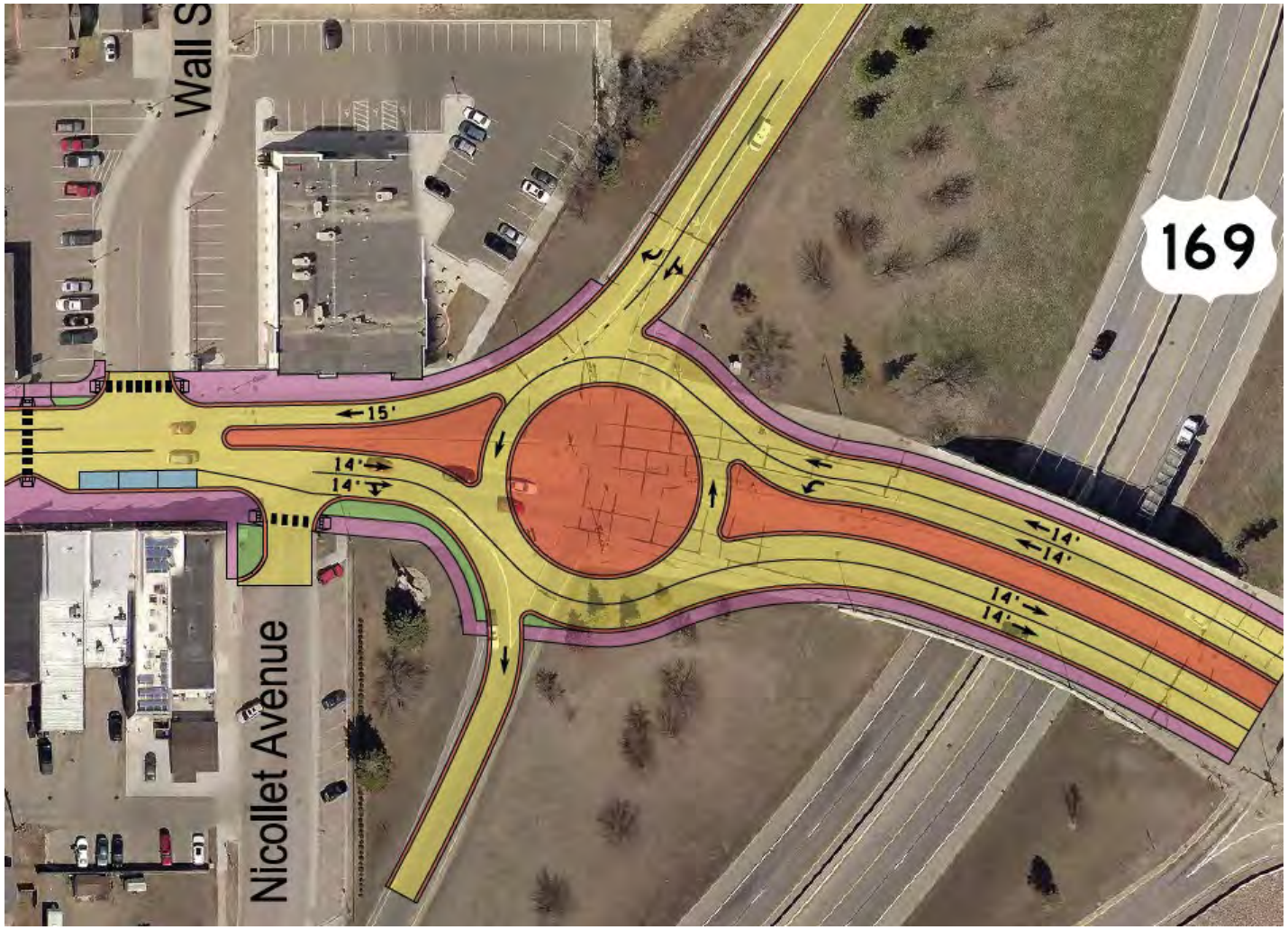
**Cons:**
- Cost to construct improvement

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

## Middle Subarea Concepts

Belgrade Avenue – Roundabout

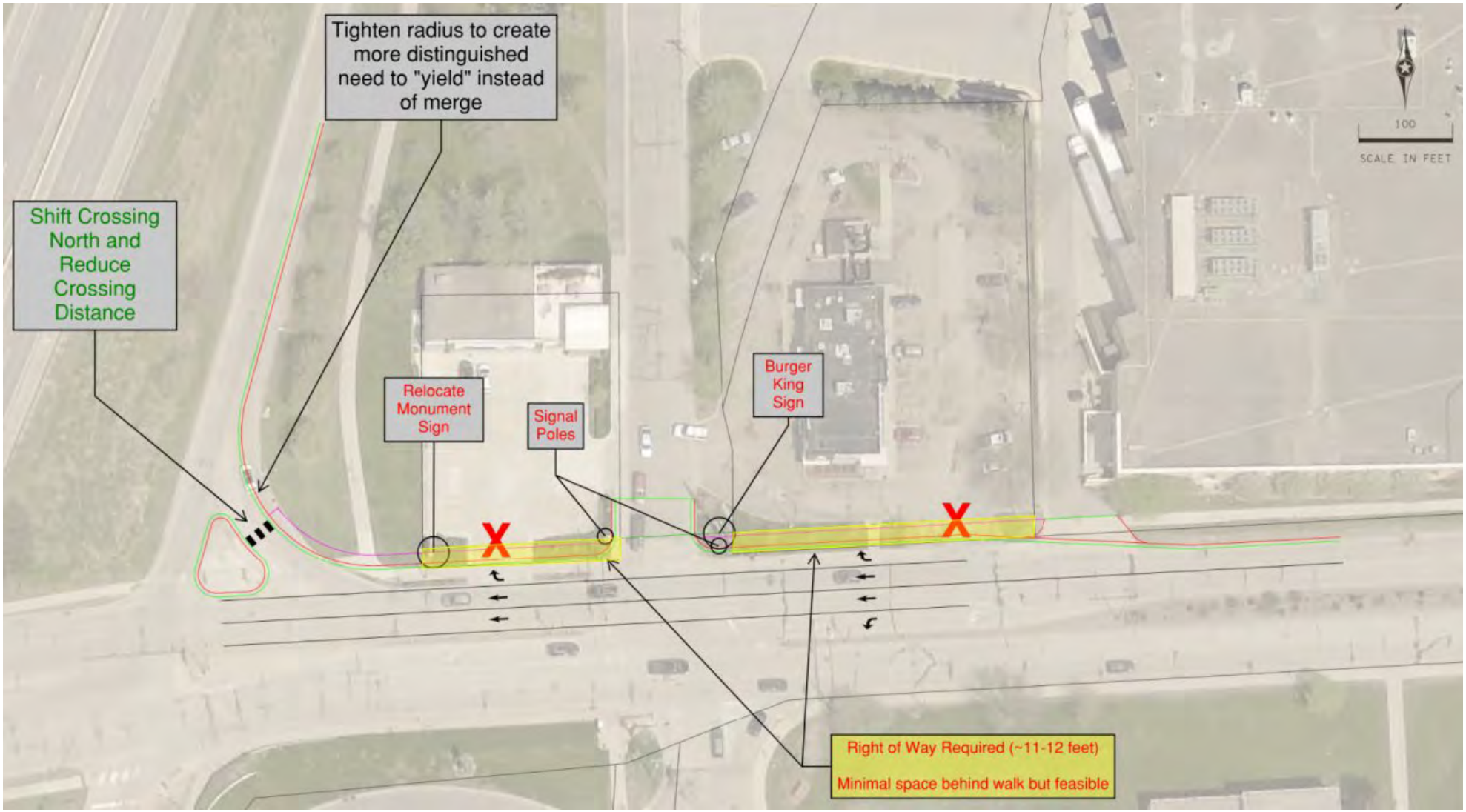



**Pros:**
- Improves pedestrian crossings
- Traffic operates well
- Improves traffic flow into potential reduced section west of Highway 169

**Cons:**
- Cost to construct improvement

**Middle Subarea Concepts**

Riverfront Drive - Right Turn Lane Concept




**Pros:**
- Improves pedestrian crossing
- Enforces need for WBR traffic to yield
- Adds channelized WBR turn lane
- Reduces WB rear end crashes
- Reduces access along Riverfront Drive

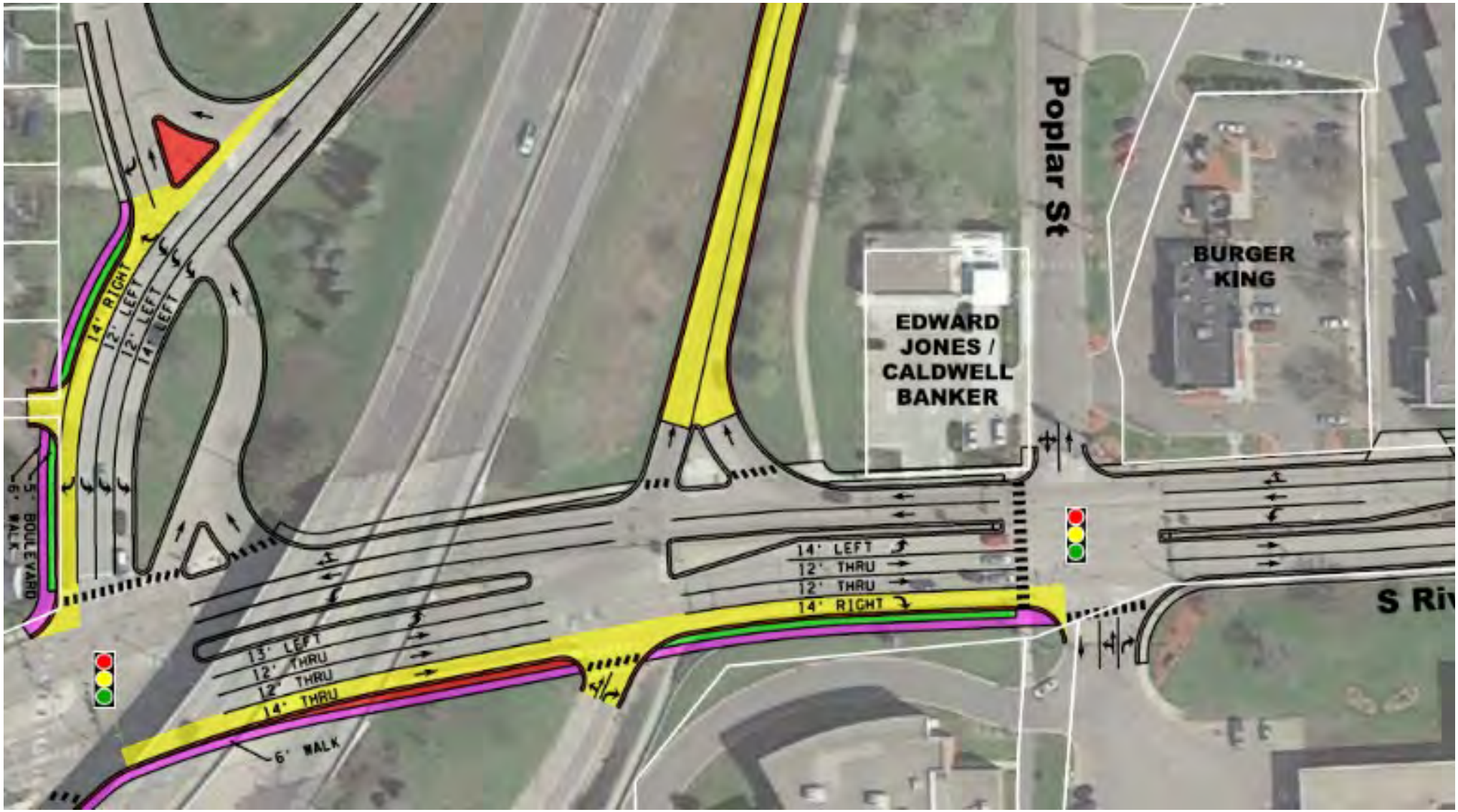
**Cons:**
- Increases WBR delay (drivers assume free movement under existing conditions)
- Right of way required
- Unlikely business supportive with reduced access

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Middle Subarea Concepts**

Riverfront Drive - Signalized Corridor Concept




**Pros:**

- Improves traffic operations with triple SBL and additional lane along northbound ramp
- Full access is maintained at all intersections (at ramps and to the east)

**Cons:**

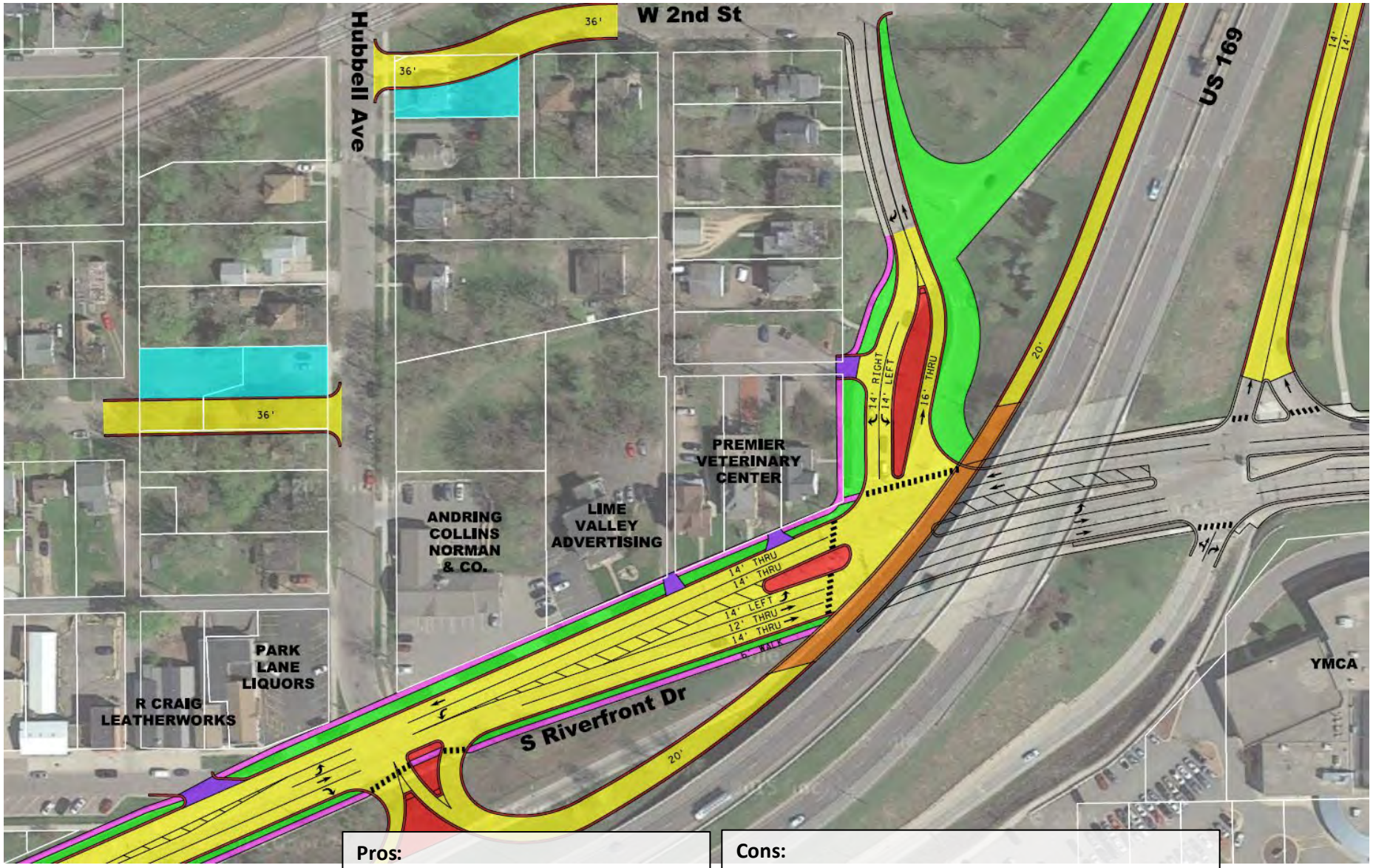
- Potential property acquisition
- Potential bridge abutment work to accommodate third lane (or elimination of sidewalk)
- Unfamiliar drivers may not use proper lane and end of weaving/slowing down traffic flow
- Uncertainty of drivers utilizing all three SBL turn lanes as intended

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

## Middle Subarea Concepts

Riverfront Drive - Riverfront Drive West of Highway 169 Concept




**Pros:**

- Improves traffic operations with existing heavy SBL now an NBR
- Access points east of Highway 169 along Riverfront Drive could remain in place as is

**Cons:**

- Design challenges with bringing loop ramp down to Riverfront Drive (need to elevate Riverfront Drive)
- $$$
- Lose Hubbell Avenue connection to Riverfront Drive (need additional local connections for circulation)

MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

# Evaluation Memo Appendix D

ENVIRONMENTAL IMPACT SUMMARY

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

# Environmental Impact Summary
# Highway 169 Corridor Study

| Social, Economic or Environmental Topic | Considerations | Existing Conditions | Concept (Negative) Scoring Considerations** |
|---|---|---|---|
| **Water Resources** | Effects to water resources. Wetlands that may be impacted by partial or complete filling, excavation or drainage, or severance of water supply (see Figure 1) | • The study area falls within the Mankato Watershed of the Minnesota River Basin. The Minnesota and Blue Earth Rivers are identified as impaired streams near the study area.<br>• The study area falls within the Mankato Watershed of the Minnesota River Basin. The Minnesota and Blue Earth Rivers are identified as Public Waters Inventory (PWI) watercourses near the study area over which the MnDNR Waters has regulatory jurisdiction.<br>• There are many small unnamed ponds in the areas surrounding the two rivers. And many of the areas surrounding the rivers and ponds are designated wetlands, either freshwater emergent or freshwater forested.<br>• Other major water features include Hiniker Pond which lies to the west of Highway 169 to the southwest of the Highway 169/Highway 14 interchange. | <u>Northern Subarea:</u><br>Concept 1A-1C New road alignment north of Hiniker Pond and Highway 14 ramp adjustments pose medium risk for impacts that will need to be studied with a future project.<br><br>Concept 2A - Highway 14 West to Highway 169 ramp would impact the existing wetland in the northeast quadrant.<br><br>Highway 14 pedestrian bridge trail concept - Trail connections needed with the TH 14 bridges connection could potentially disturb areas along the MN River. |
| **Floodplains** | Development encroachments on the 100-year floodplain (see Figure 2) | • The Corridor falls within the 100- year and 500-year floodplain of the Minnesota River in several sections throughout the study area.<br>• A large portion of the northern subarea is within the 500-year floodplain and small segments of the middle and southern subareas run through the 100-year floodplain (See Figure 2). | <u>Northern Subarea:</u><br>Concept 2A - The full interchange configuration would warrant modifications to the Minnesota River levee that protects the City of Mankato and North Mankato from flood waters produced by the Minnesota River. Further coordination with FEMA will be required to understand the requirements associated with levee modifications or relocations.<br><br>Concept 2D - Highway 14 West to Highway 169 ramp would impact the existing wetland and flood levee. Further coordination with FEMA will be required to understand the requirements associated with levee modifications or relocations. |
| **Surface Water Drainage/Water Quality** | Effects of drainage modifications. Run-off effects to protected lakes and watercourses | Drainage infrastructure alterations and impervious surface additions may affect the bodies of water. To be considered in future environmental review.* | |
| **Wildlife, Threatened and Endangered Species** | • Unique habitats<br>• Widened section<br>• Federal and state listed threatened and endangered species | • MnDNR Natural Heritage Information System (NHIS) data suggests threatened, endangered, and rare species do not exist within the immediate study area. However, species have been identified within close proximity along the shore of the Minnesota River near the Veteran's Memorial Bridge. These locations are separated from the study area by a concrete levee wall and roughly 200 feet of land and the species are aquatic. It is unlikely that roadway alternatives could effect these species.<br>• GIS Data delineating MNDNR, Division of Wildlife Management Areas (WMA) show WMA's are non-existent within the study area. | |
| **Fisheries** | • Trout streams<br>• Fish migrations<br>• Spawning runs<br>• Unique habitats | There are no designated trout streams within the study area. | |
| **Vegetation** | • Native plant communities<br>• Landscape vegetation<br>• Functional vegetation<br>• High value vegetation<br>• Hazard trees | • The study area is dominated by developed industrial, commercial, and agricultural uses with altered vegetation.<br>• Most of the native plants communities exist in the southern subarea and the Minneopa State Park is directly adjacent the study area here too. In the northern subarea, the Kiwanis Recreation Area is within close proximity to the corridor.<br>• To be considered in future environmental review.* | |
| **Contaminated Properties** | Disturbance of contaminated properties may increase project cost (see Figure 3) | • Known history of contamination in the study area. MPCA "What's in My Neighborhood?" sites that are located within 150 feet of the corridor were selected as relevant and can be seen in Figure 3.<br>• More detailed investigations may be recommended for properties with existing/past land uses that may have used hazardous/chemical waste. To be considered in a future environmental review.* | <u>Northern Subarea:</u><br>Concept 1A-1C Based on environmental screening there are several hazardous waste areas south of the Highway 14 interchange, most south of Hiniker Pond.<br><br>Concept 1B - Intersection improvements at both River Lane and Webster Avenue have larger disturbance footprint in this area.<br><br>Concept 2A - An interchange at Webster Avenue would have a larger disturbance footprint in this area.<br><br>Webster Avenue grade separated pedestrian concept could result in a large disturbance area.<br><br><u>Southern Subarea:</u><br>Concept 2B1 and 2B2 - could disturb hazardous areas near the Highway 120 intersection. |
| **Parks and Recreation Areas (Section 4f/6f Resources)** | • Parks and recreation areas<br>• Land and Water Conservation (LAWCON) funds<br>• Wildlife & waterfowl refuges<br>• Historic sites<br>• Landscapes<br>• Highways<br>• Bridges<br>• Buildings & districts<br>• Wildlife management areas<br>• School playgrounds<br>• Fairgrounds<br>• Public multiple-use land holdings<br>• Public golf courses<br>• Archaeological sites<br>• Wild & scenic rivers<br>• Recreational bikeways and trails (see Figure 4) | • The following properties may qualify as Section 4f and are adjacent to the corridor:<br>-Parks<br>• Bluff Park<br>• Kiwanis Recreation Area<br>• Hiniker Park<br>• Riverview Park<br>• Reconciliation Park<br>• Land of Memories Park<br>• Minneopa State Park<br>• The following are LAWCON (Section 6f) properties and are adjacent to the corridor:<br>- Trails<br>• The Minnesota River Trail<br>• The North Star Bridge Trail<br>• The Rex Macbeth River Trail<br>• The West Mankato Trail<br>• Bluff Valley Trail<br>• Hiniker Park Trail<br>• The Kiwanis Mountain Bike Trail<br>• Any impacts to parks and recreational areas to be considered in a future environmental review* | |

# Environmental Impact Summary
# Highway 169 Corridor Study

| Social, Economic or Environmental Topic | Considerations | Existing Conditions | Concept (Negative) Scoring Considerations** |
|---|---|---|---|
| **Social and Community** | • Hospitals<br>• Schools<br>• Libraries<br>• Churches<br>• Government buildings<br>• Post offices | • The following are located within or in close proximity to the study corridor<br>• New Creation World Outreach Church<br>• Mankato West High School<br>• Hillcrest Rehabilitation Center<br>• North Mankato United States Postal Service | |
| **Cultural Resources** | Buildings that exceed 50 years in age, archaeological sites, and Traditional Cultural Properties. | • Cultural and Historic properties will need to be reviewed when specific projects are identified for this corridor. Even though there are no designated tribal lands in this area, the confluence of the Blue Earth and Minnesota Rivers has cultural significance for the Dakota people. | <u>Northern Subarea:</u><br>Highway 14 pedestrian bridge trail concept - Connections needed could potentially disturb areas along the MN River. |
| **Pedestrian & Bicycle Facilities** | Bicycle and pedestrian safety | • Sidewalk and trail connections exist along Highway 169 and intersecting roadways in many areas throughout the study area but safe crossings of Highway 169 lack throughout. See 6f resources listed above.<br>• To be considered in future environmental review.* | |
| **Environmental Justice** | Disproportionate effects to low-income or minority populations (see Figures 5 and 6) | • There are two block groups above 23 percent minority populations within the study area (Figure 4). Due to the significantly greater minority population compared to the general population than the counties, both of these block groups can be considered environmental justice populations.<br>• There are 11 block groups above 26 percent low-income populations that fall within the project area (Figure 5). The block groups range between 26 percent and 70 percent of populations that have low incomes. Due to the significantly greater low-income concentrations compared to the general population than the counties, all 11 block groups can be considered environmental justice populations. | <u>Southern Subarea:</u><br>Grade separated pedestrian trail concepts - No Build is high risk given consideration that existing conditions and all proposed concepts do not provide safe pedestrian crossings of Highway 169.<br><br>Generally for the entire study area, no data suggests that EJ populations use this area significantly more than other populations (i.e., travel to the corridor or drive through it), so there is no reason to assume impacts would be disproportionately high. |
| **Air Quality** | • Impacts to air quality<br>• Mobile source air toxins | The need for an air quality analysis, conformity determination, or Mobile Source Air Toxics analysis will be determined once individual improvement projects are identified.* | |
| **Traffic Noise** | • Comply with federal noise criteria and Minnesota Noise Standards<br>• Identify sensitive noise receptors | The need for a noise analysis will be determined once individual improvement projects are identified.* | |
| **Construction Noise** | • Comply with federal noise criteria and Minnesota Noise Standards<br>• Identify sensitive noise receptors | Construction noise will be further considered in a future environmental review as projects are implemented.* City ordinances can regulate the daytime hours of construction activities in order to minimize potential impacts to adjacent areas. | |
| **Utilities** | Impacts to utilities may incur additional project costs. | • To be considered in future environmental review.* | |
| **Erosion** | • Erosional effects<br>• Water pollution | To be considered in a future environmental review.* | |
| **Right of Way and Relocation** | Effects of right of way acquisition | Additional right-of-way may need to be acquired for future improvement projects. Temporary easements and changes to local roadway and property access points are also likely. Any impacts resulting from right-of-way acquisition, relocation or access changes will be identified in a future environmental review.* | <u>Northern Subarea:</u><br>Concept 2A - Highway 169 North to Highway 14 East ramp would impact McDonald's building.<br><br>Grade separated pedestrian concepts north of Lind Street and on the south side of Webster Avenue will require future detailed analysis of grades and bridge type foot print. Built out environment could result in some partial property impacts.<br><br><u>Southern Subarea:</u><br>Concept 2B2 - three partial acquisitions anticipated.<br>Concept 2C - three total acquisitions and four partials anticipated.<br>Concept 3A - five partial acquisitions anticipated.<br>Concept 3B - two total acquisitions and two partials anticipated. |
| **Visual Quality** | • Scenic intrusion<br>• Bridges<br>• Lighting<br>• Railings<br>• Grading, Trails<br>• Walls<br>• Fencing<br>• Vegetation Modifications | The proposed project is not anticipated to result in adverse visual impacts. | |
| **Farmland and Soils** | • Minimization of effects to agricultural land<br>• Properties of soils<br>• Suitability for roadway construction | • Soil suitability of farmland impacts will be addressed in a future environmental review.* | |

*Additional study considerations will be pursued when improvements are identified.
**If a concept is not mentioned it poses low risk for negative impacts.

T:\MAPO_MU\T61120619\2_Preliminary\C_Reports\Environment

**Figure 1: Water Resources**

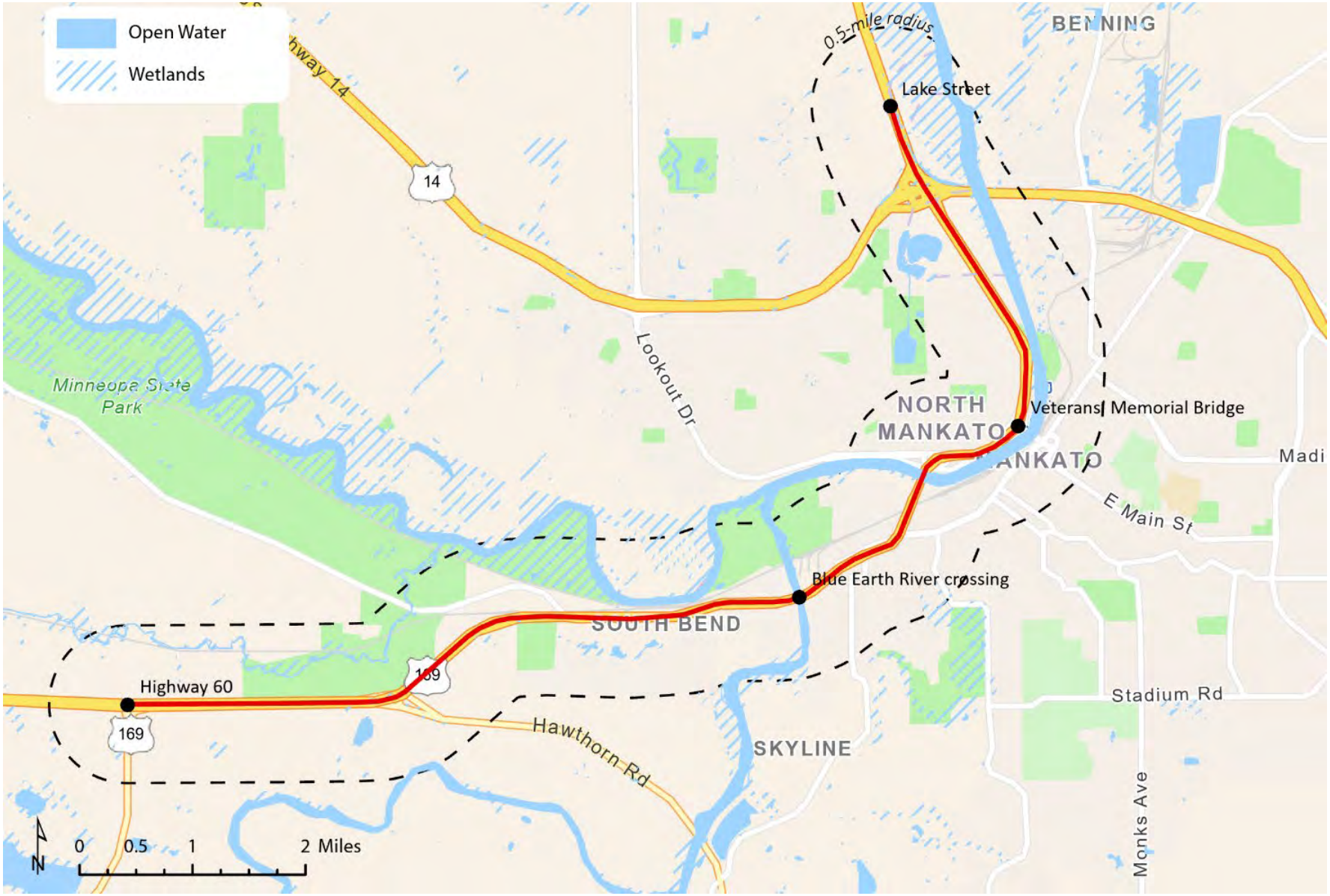


**Figure 2: Flood Plains**

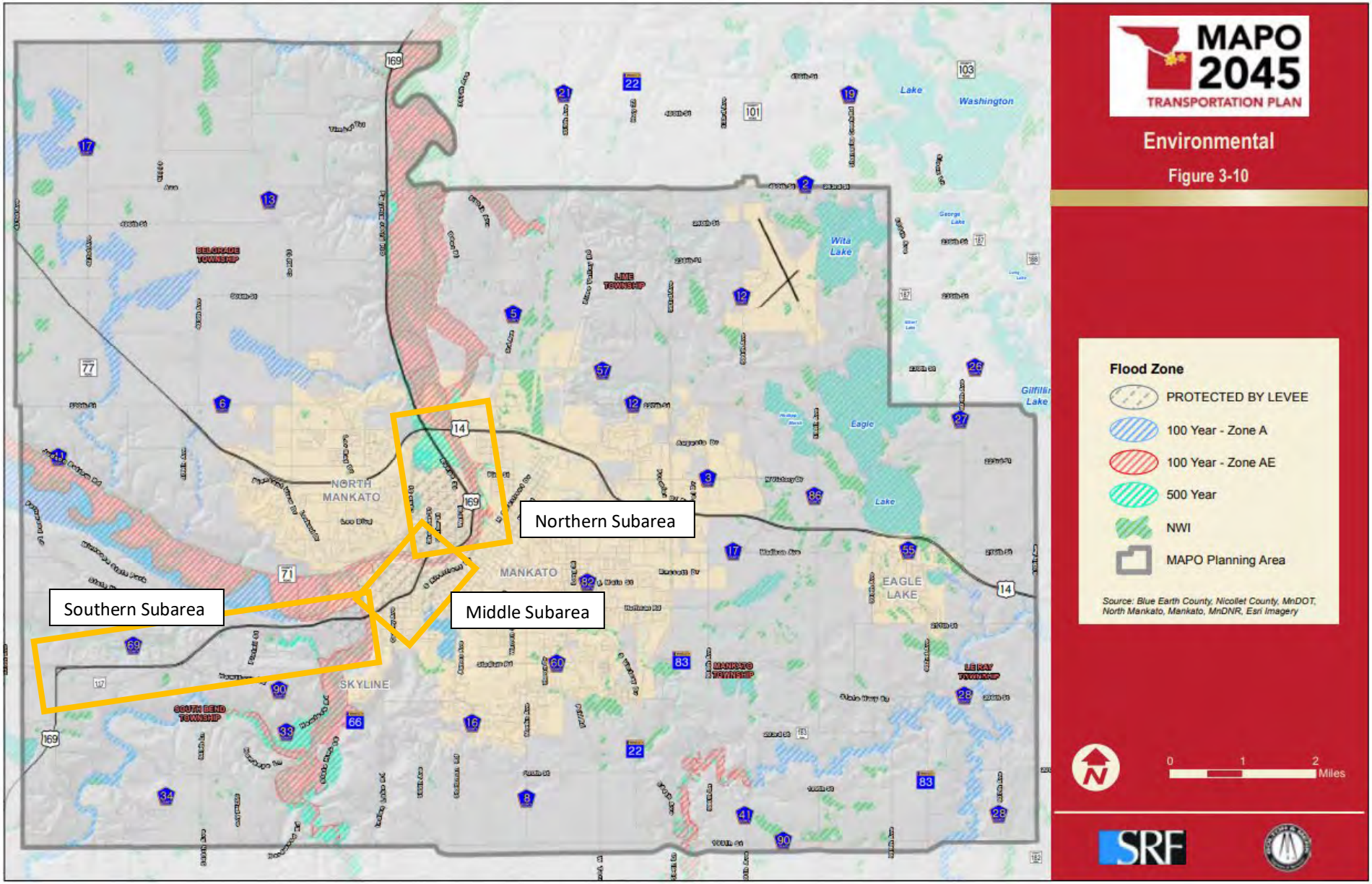


**Figure 3: Potentially Contaminated Sites**

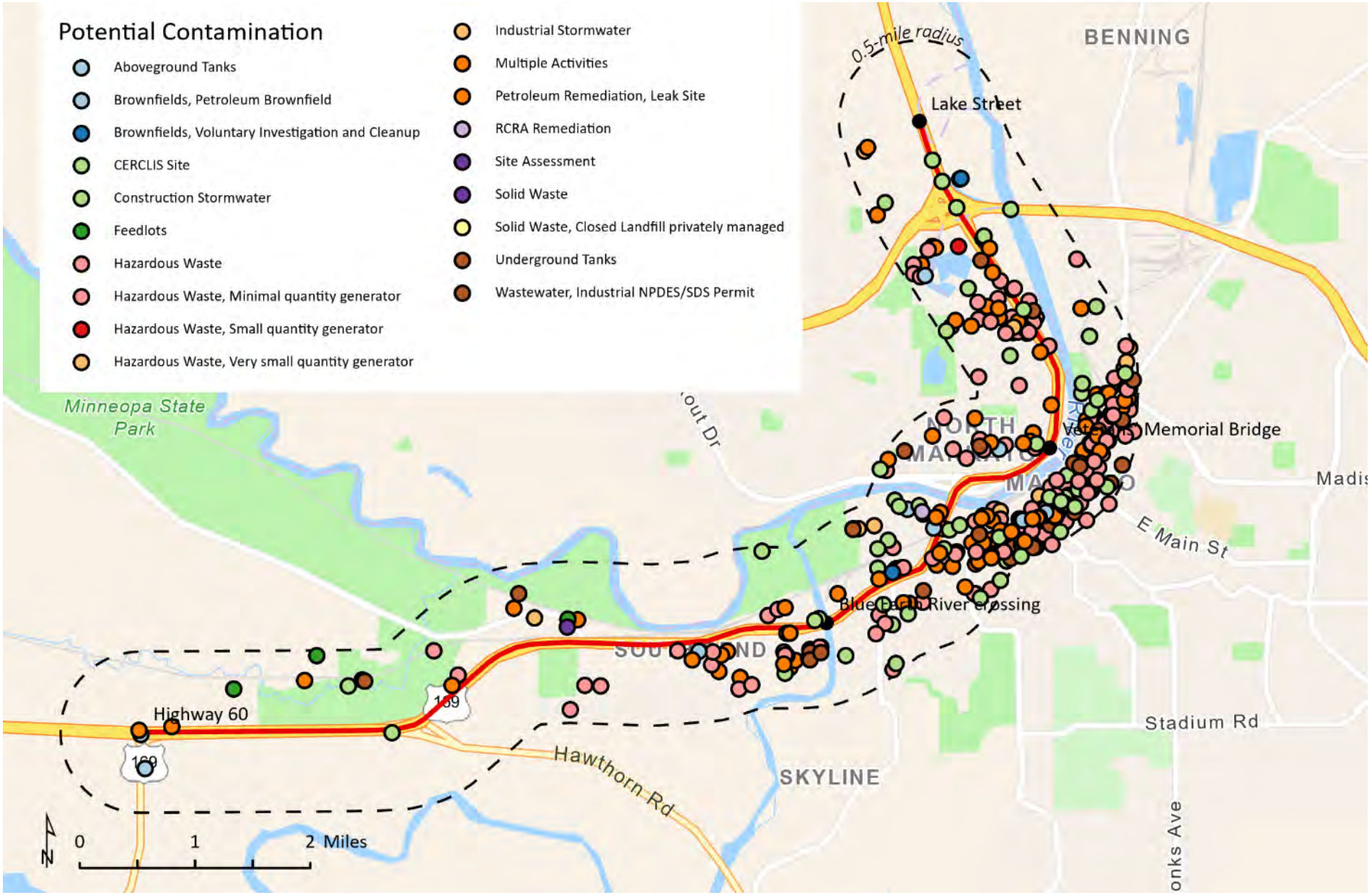


**Figure 4: Existing Land Use**

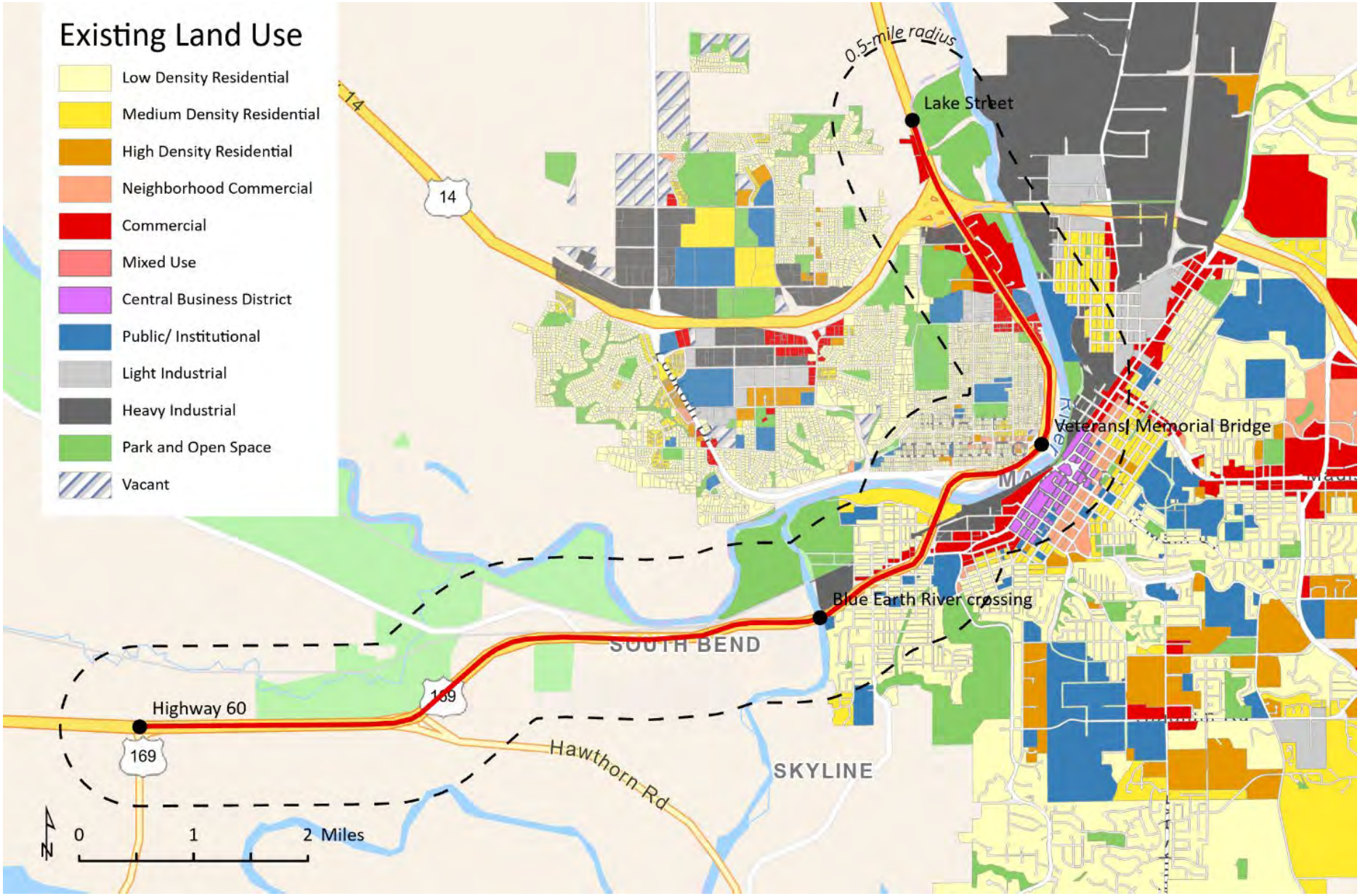


**Figure 5: Percent Minority Individuals by Block Group**

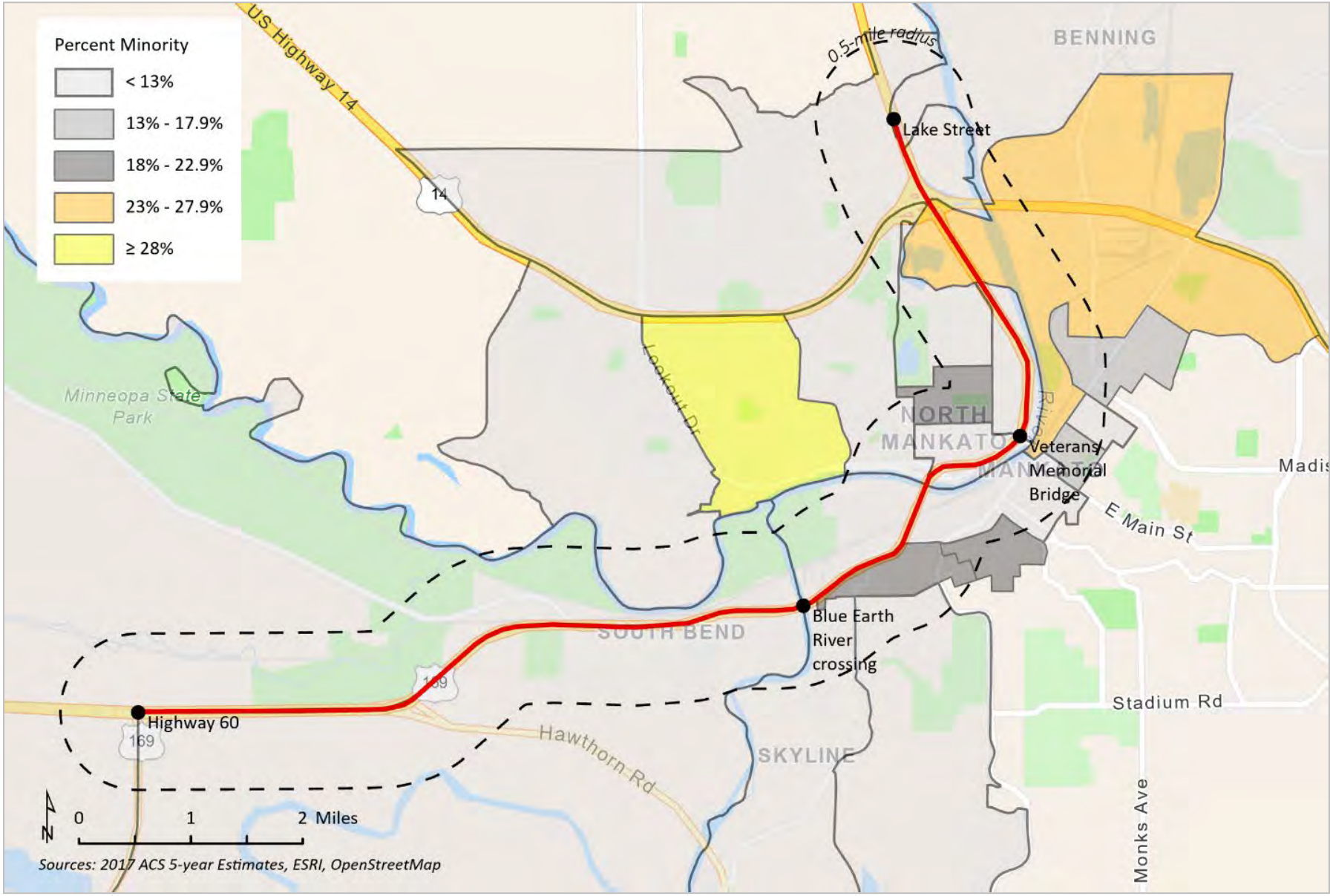
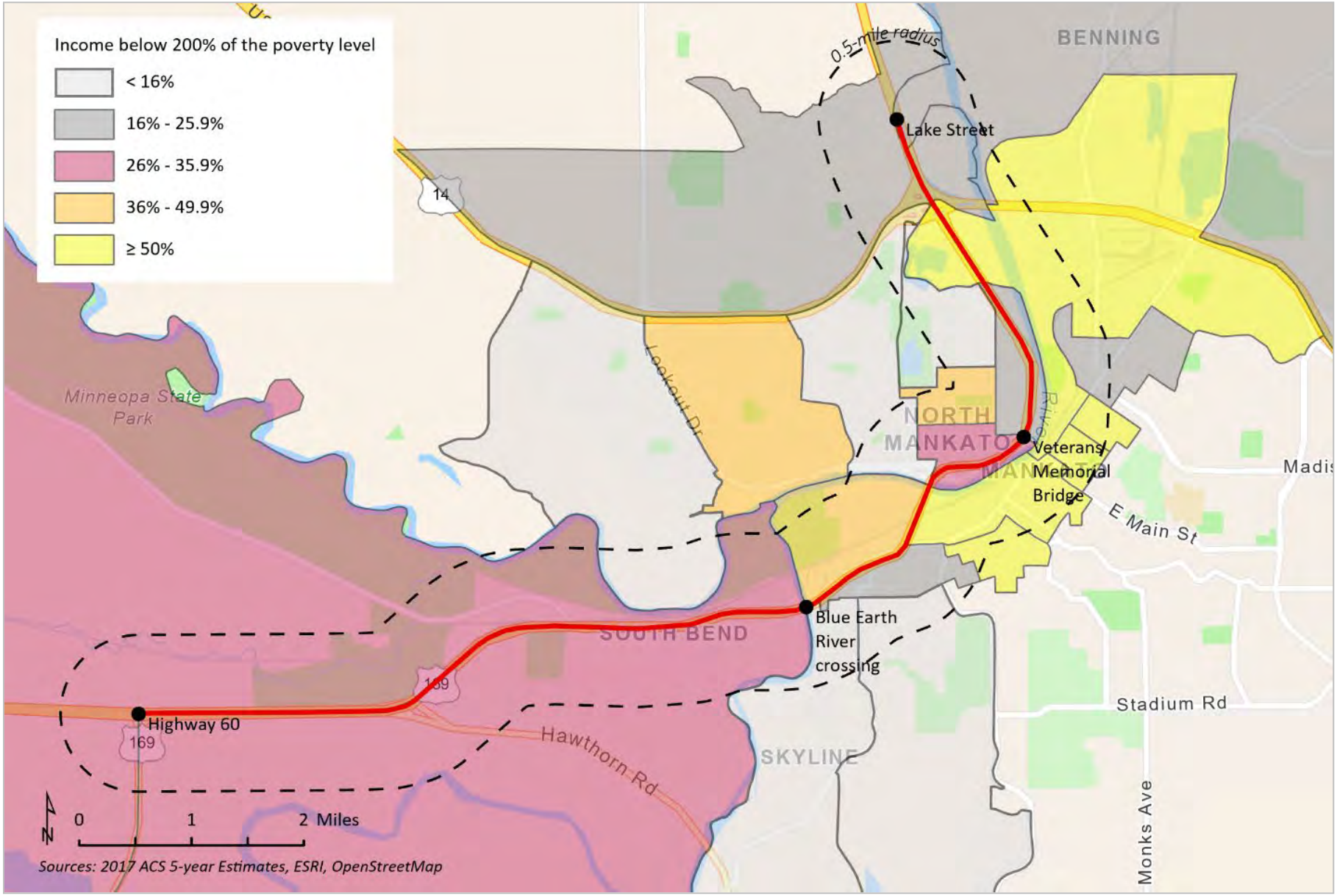


**Figure 6: Percent Low-Income Individuals by Block Group**



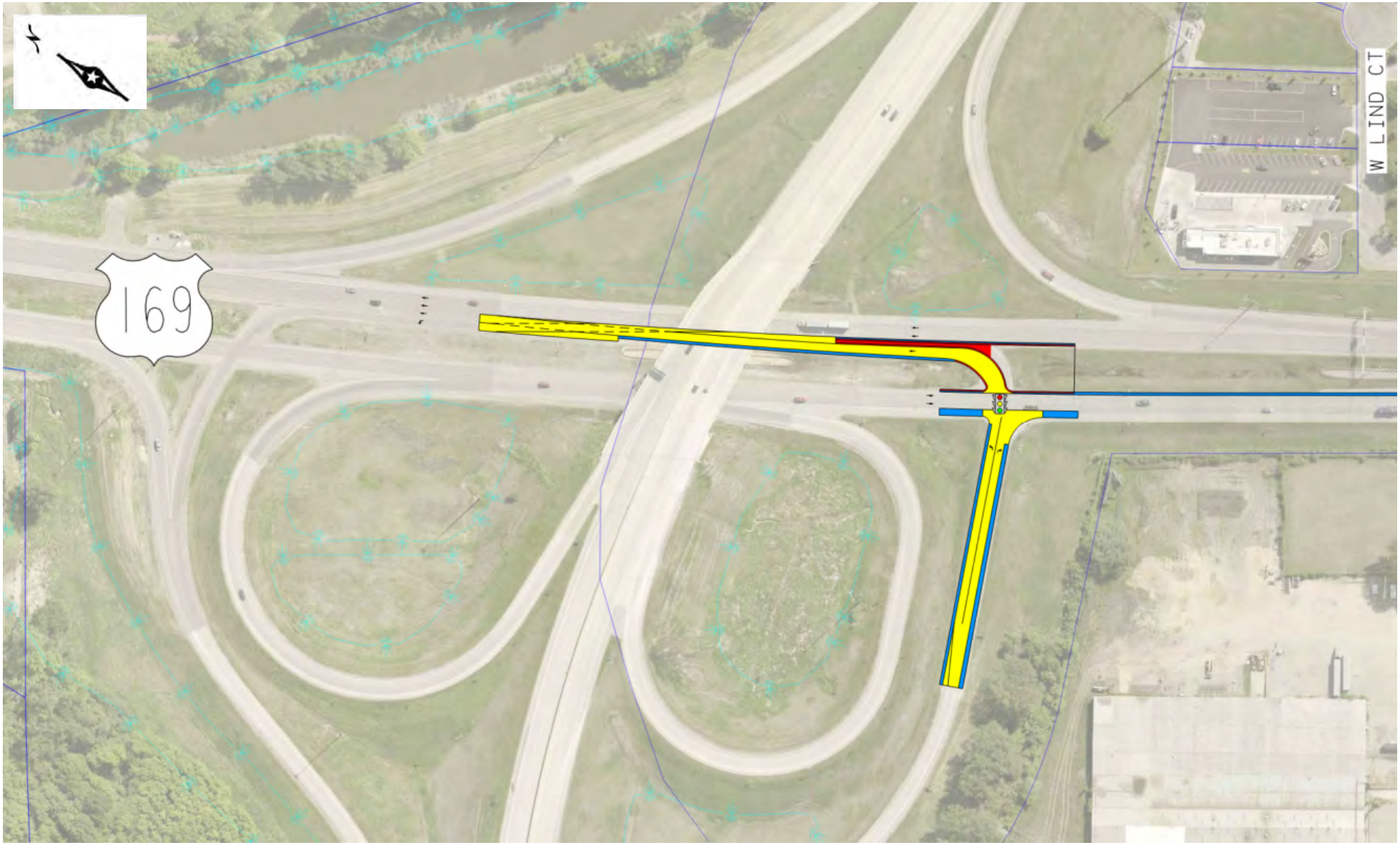
# Evaluation Memo Appendix E

DISMISSED CONCEPTS

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

**Northern Subarea – Dismissed Concepts**

Signalized Green T at Eastbound TH 14 Exit Ramp

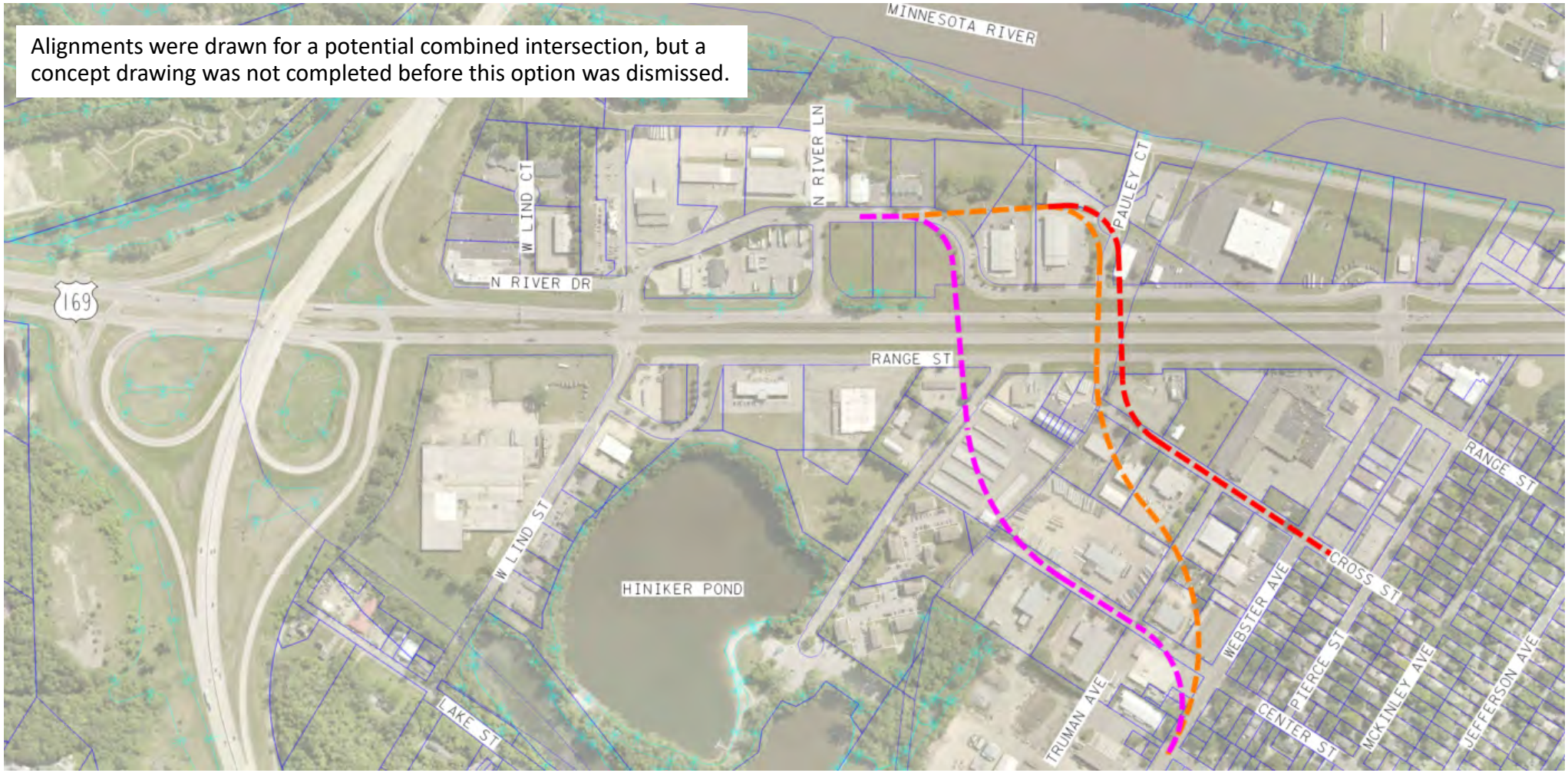



MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Northern Subarea – Dismissed Concepts**

Combined Intersection – Lind Street, River Lane, Webster Avenue

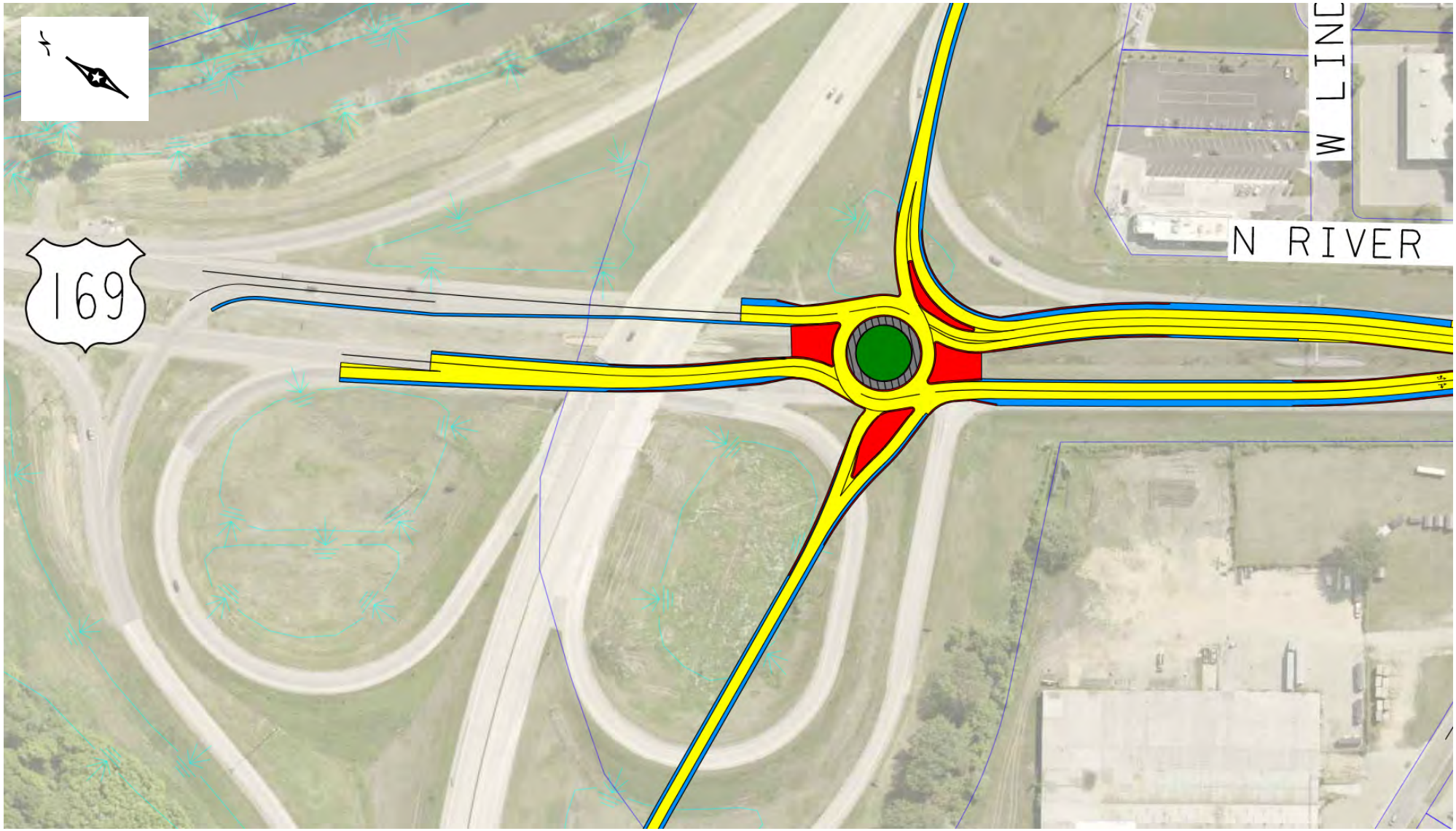



MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Northern Subarea – Dismissed Concepts**

Option 2B – TH 14 Interchange (Eliminate South Loop – Roundabout)

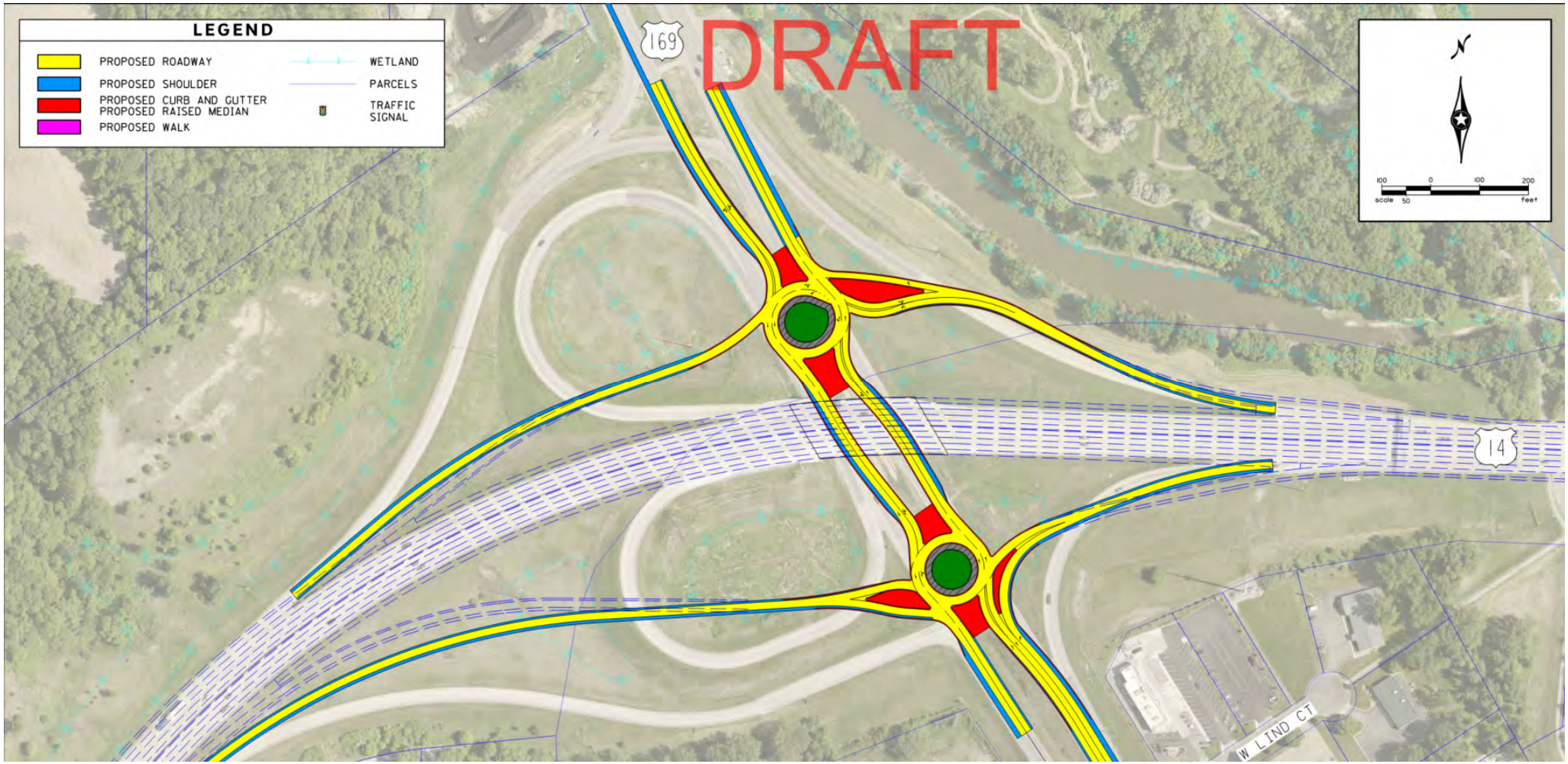



MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Northern Subarea – Dismissed Concepts**

Option 2E – TH 14 Interchange (Roundabout Ramp Intersections)

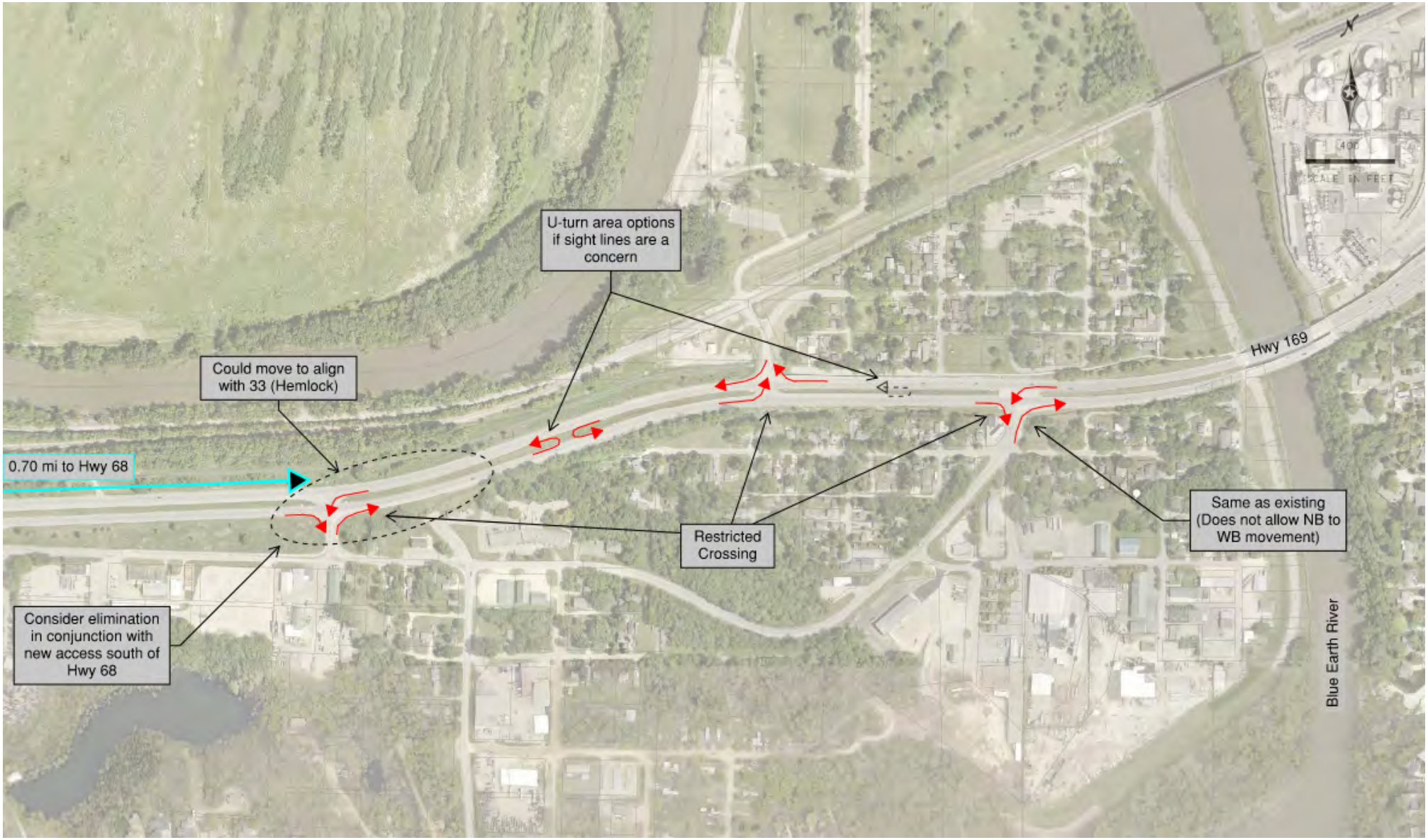



MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Southern Subarea – Dismissed Concepts**

Section 1: Alternative 1A

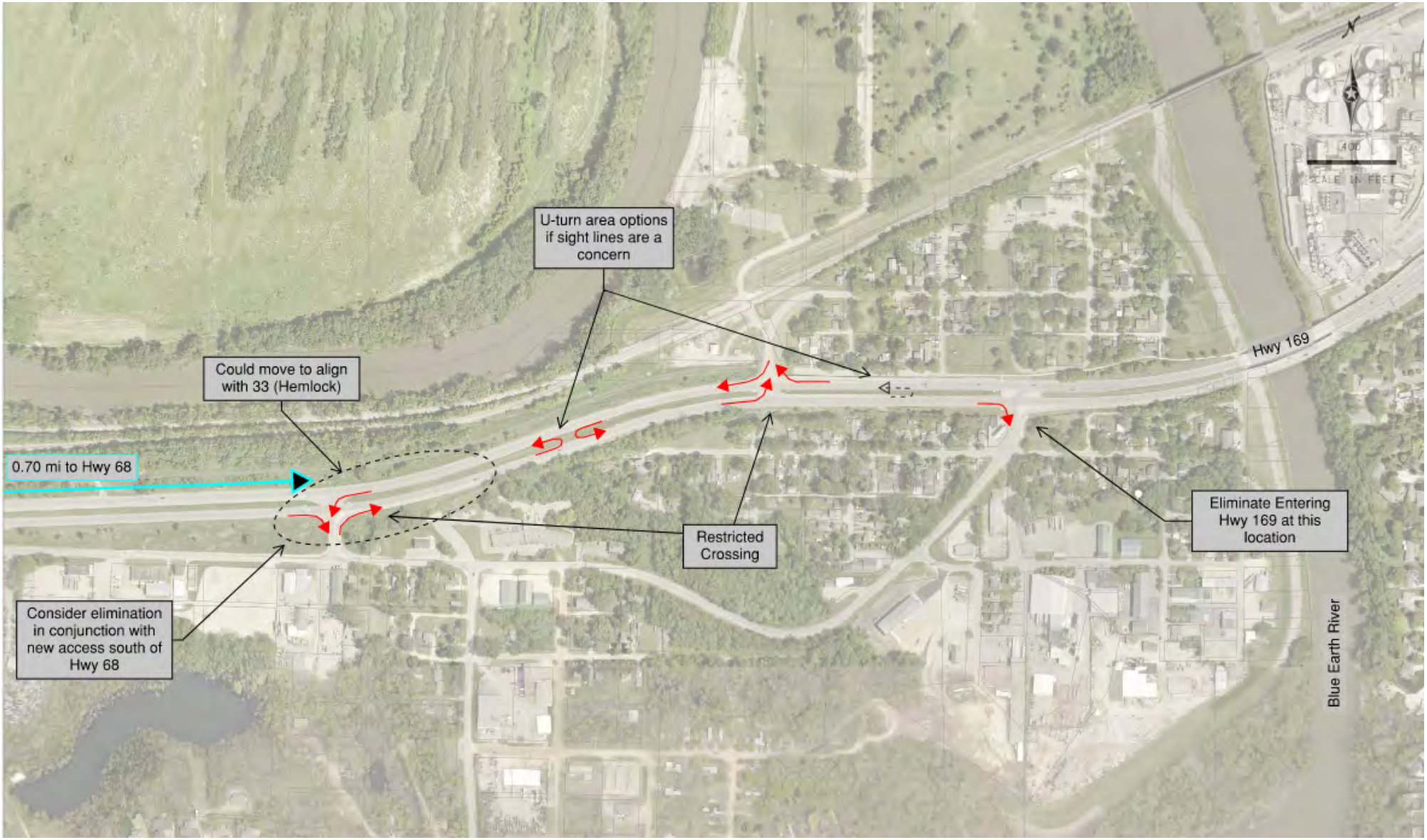



MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

**Southern Subarea – Dismissed Concepts**

Section 1: Alternative 1B




MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

BOLTON & MENK
Real People. Real Solutions.

# Evaluation Memo Appendix F

BENEFIT COST ANALYSIS MEMORANDUM

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

# Highway 169 Corridor Study

## Benefit Cost Analysis

**Date:** August 25, 2021

**To:** Charles Androsky, Transportation Planner, MAPO

Ronda Allis, PE, MnDOT

**From:** Scott McBride, PE, Project Manager, Bolton & Menk, Inc.

Kelsey Retherford, PE, Traffic Engineer, Bolton & Menk, Inc.

**Subject:** Benefit Cost Analysis

Highway 169 Corridor Study

Mankato/North Mankato Area Planning Organization (MAPO)

BOLTON & MENK
Real People. Real Solutions.

# Introduction

The Mankato/North Mankato Area Planning Organization (MAPO) in collaboration with the Cities of North Mankato, Mankato, Blue Earth County, Nicollet County, and the Minnesota Department of Transportation (MnDOT) are working to identify transportation improvements on Highway 169. This report summarizes the detailed benefit cost analysis of the Northern Subarea concepts.

# Concepts

A benefit cost analysis was completed for the following concepts:

- **Concept 1a – Signalized Expressway:** Signals at combined Lind St/River Ln and Webster Ave intersections
- **Concept 1b – Roundabout Expressway:** Roundabouts at combined Lind St/River Ln and Webster Ave intersections
- **Concept 1c – RCUT Expressway:** Signalized RCUTs (Restricted Crossing U-Turn)at combined Lind St/River Ln and Webster Ave intersections
- **Concept 1d – Freeway:** Interchange at Webster Ave and TH 169, close Lind St/River Ln access
- **Concept 2a – Freeway:** Full cloverleaf interchange at TH 169/TH 14
- **Concept 2c – Spot Interchange Improvements - Expressway:** Eliminate South to East loop and signalize TH 169 at EB TH 14 Ramps
- **Concept 2d – Spot Interchange Improvements - Expressway:** Convert TH 14 at TH 169 to a Diverging Diamond interchange
- **Concept 2f – Spot Interchange Improvements - Expressway:** Signalize TH 169 at EB TH 14 Exit Ramp

Concept drawings are included in the **Appendix**.

# Safety Benefit

## Lind St/River Ln/Webster Ave Concepts

Crash reduction factors for the alternatives were taken from the Highway Safety Manual, CMF Clearinghouse, and MnDOT technical memos. The reduction factors were used in combination with the standard HSIP Benefit-Cost Calculation worksheets to generate benefits associated with crash reductions. A traffic growth rate of 1.2% was determined comparing the existing and future peak hour turning movement volumes. Additionally, a discount rate of 1.0% and a project lifespan of 20 years was assumed based on MnDOT Benefit-Cost Analysis and HSIP guidance. Crash data from the last 5 years at Lind St, River Ln, and Webster Ave were analyzed for Concepts 1a-1d.

The crash reductions assumed for each concept are described below.

- **Concept 1a – Signalized Expressway:** No crash reduction was assumed since this option does not change the intersection of TH 169 at Webster Ave and only combines Lind St/River Ln traffic at signal which is similar to the existing condition.

- **Concept 1b – Roundabout Expressway:** Crash reductions (and increases) were taken from Table 15 of "A Study of the Traffic Safety at Roundabouts in Minnesota (2017)" which shows percent increase/decreases in crashes by severity for 2x1 roundabouts statewide.
- **Concept 1c – RCUT Expressway:** Crash reductions were taken from the 2017 MnDOT Study of the Traffic Safety at Reduced Conflict Intersections and the MnDOT Tech Memo: Restricted Crossing U-Turn - Design and Implementation Guidance. The reports show a crash reduction of 77% for angle crashes and a 35% reduction for all other crashes.
- **Concept 1d – Freeway (Interchange at Webster):** Crash reductions for converting an at grade intersection into a grade separated interchange was taken from the Highway Safety Manual. The HSM shows a 57% reduction in injury crashes and a 42% reduction in all other crashes. Additionally, CMFs for converting an intersection to a roundabout were applied. CMF ID 9157 was applied to all injury crashes (44% reduction) and CMF ID 10084 was applied to all property damage only crashes (36% reduction)

The present value safety benefits are shown in **Table 1** for the Concepts 1a-1d. The HSIP Benefit-Cost Calculation worksheets used to determine the present value cost of crashes are included in the **Appendix**.

**Table 1. Safety Benefits for Lind/River/Webster Concepts**

| Concepts | Safety Benefit |
|---|---|
| Concept 1a. Signalized Expressway | $ - |
| Concept 1b. Roundabout Expressway | $ 386,419 |
| Concept 1c. RCUT Expressway | $ 7,798,000 |
| Concept 1d. Interchange at Webster | $ 14,711,915 |

## TH 14 Interchange Concepts

Applicable crash reduction factors were not available for all of the TH 14 interchange concepts. Therefore, a new approach was used to determine the safety benefit with each concept. First, the conflict points with each concept were analyzed and compared to the existing condition. The following table shows the conflict points and change in conflict points from the existing condition.

**Table 2. TH 14 Concept Conflict Points**

| Concepts | Conflict Points | Change in Conflict Points |
|---|---|---|
| No Build/Existing Condition | 4 crossing, 8 diverging, 8 merging | N/A |
| Concept 2a. Full Cloverleaf Interchange | 0 crossing, 8 diverging, 8 merging | 4 less crossing |
| Concept 2c. Eliminate South Loop - Signal | 6 crossing, 8 diverging, 9 merging | 2 more crossing, 1 more merging |
| Concept 2d. Diverging Diamond | 9 crossing, 8 diverging, 9 merging | 5 more crossing, 1 more merging |
| Concept 2f. Signalize EB TH 14 Exit Ramp | 4 crossing, 8 diverging, 8 merging | No change |

The change in crossing conflict points was used to determine the increase or decrease in angle crashes and the change in merging/diverging conflict points were used to determine the increase or decrease in sideswipe crashes anticipated. The increase/decrease in angle and sideswipe crashes with concept are listed below.

- **Concept 2a – Freeway (Full Cloverleaf):** With 50% fewer crossing conflict points, concept 2a was assumed to have a 50% reduction in angle crashes at the TH 14 interchange.
- **Concept 2c – Spot Interchange Improvements – Expressway (Eliminate South Loop – Signalize):** With 150% more crossing conflict points, concept 2c was assumed to have a 150% increase in angle crashes

at the TH 14 interchange. With 113% more merging conflict points, concept 2c was assumed to have a 113% increase in sideswipe crashes at the TH 14 interchange.

- **Concept 2d – Spot Interchange Improvements – Expressway (Diverging Diamond):** With 225% more crossing conflict points, concept 2d was assumed to have a 225% increase in angle crashes at the TH 14 interchange. With 113% more merging conflict points, concept 2d was assumed to have a 113% increase in sideswipe crashes at the TH 14 interchange.
- **Concept 2f – Spot Interchange Improvements – Expressway (Signalize EB TH 14 Exit Ramp):** With no change in conflict points from the existing scenario, no change in angle or sideswipe crashes were assumed.

The percent reduction/increase was used in combination with the standard HSIP Benefit-Cost Calculation worksheets to generate benefits associated with crash reductions. A traffic growth rate of 1.2% was determined comparing the existing and future peak hour turning movement volumes. Additionally, a discount rate of 1.0% and a project lifespan of 20 years was assumed based on MnDOT Benefit-Cost Analysis and HSIP guidance. Crash data from the last 5 years at the TH 14/TH 149 interchange were analyzed.

The safety benefit due to anticipated changes in angle and sideswipe crashes is shown in **Table 3** below. Values in parenthesis indicate a negative safety benefit (increase in crashes).

**Table 3. Safety Benefits (Angle and Sideswipe Crashes) for TH 14 Concepts**

| Concepts | Safety Benefit |
|---|---|
| Concept 2a. Full Cloverleaf Interchange | $ 2,458,951 |
| Concept 2c. Eliminate South Loop - Signal | $ (7,516,981) |
| Concept 2d. Diverging Diamond | $ (1,220,407) |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ - |

The existing TH 14/TH 169 interchange design results in very few rear end crashes (two in the last five years along the eastbound TH 14 exit ramp, and one along the WB TH 14 to SB TH 169 weave area), therefore, crash data at TH 169 and Lind St was used as a comparison. In order to estimate the increase in rear end crashes with the signalized concepts average 2040 AM/PM mainline delay was compared to 2040 AM/PM mainline delay at Lind St under the no build condition. The average 2040 AM/PM mainline delay with each concept and percent decrease in delay is shown in **Table 4** below. Since all of the concepts show less mainline delay than currently at Lind St, less rear end crashes are anticipated with each of the concepts than are at Lind St today.

**Table 4. Average Mainline TH 169 2040 Peak Hour Delay**

| Concepts | Average Delay (seconds/vehicle) | Percent Decrease in Delay |
|---|---|---|
| No Build/Existing Condition (Lind St) | 20 | N/A |
| Concept 2c. Eliminate South Loop - Signal | 8 | 60% |
| Concept 2d. Diverging Diamond | 5 | 75% |
| Concept 2f. Signalize EB TH 14 Exit Ramp | 2.5 | 88% |

To determine the cost of the increase in rear end crashes anticipated with each concept first the present value of rear end crashes at Lind St was calculated. This cost was found to be $10,663,593. Next the cost of rear end crashes reduced with each concept was calculated based on the percent decrease anticipated in delay since delay was assumed to be directly correlated to the number of rear end crashes. Finally, the cost of the rear end crashes that remaining with each option was determined by subtracting the cost of the reduction in rear end crashes from the cost of rear end crashes at Lind St.

HSIP Benefit-Cost Calculation worksheets were used to determine the present value cost of crashes and are included in the **Appendix**.

The safety benefit due to anticipated increase in rear end crashes is shown in **Table 5**.

**Table 5. Safety Benefits (Rear End Crashes) for TH 14 Concepts**

| Concepts | Safety Benefit |
|---|---|
| Concept 2a. Full Cloverleaf Interchange | $ - |
| Concept 2c. Eliminate South Loop - Signal | $ (4,265,437) |
| Concept 2d. Diverging Diamond | $ (2,665,898) |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ (1,279,631) |

The overall total safety benefit with each option is shown in **Table 6** below.

**Table 6. Total Safety Benefits for TH 14 Concepts**

| Concepts | Safety Benefit |
|---|---|
| Concept 2a. Full Cloverleaf Interchange | $ 2,458,951 |
| Concept 2c. Eliminate South Loop - Signal | $ (11,782,418) |
| Concept 2d. Diverging Diamond | $ (3,886,305) |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ (1,279,631) |

# Delay Benefit

Existing and forecasting turning movement counts were used to model peak hour conditions with each concept. Total network delay in hours was determined in Synchro/SimTraffic for the AM and PM peak hours for each concept to determine the delay benefits. Concept 1d was modeled assuming single lane roundabouts at the interchange ramp terminals.

**Tables 7** and **8** shows the 2020 and 2040 total network delay for each concept.

**Table 7. Total Peak Hour Network Delay for the Lind/River/Webster Concepts**

| Concepts | 2020 Network Delay (Hours) | | 2040 Network Delay (Hours) | |
|---|---|---|---|---|
| | AM Peak | PM Peak | AM Peak | PM Peak |
| No Build/Existing Condition | 27.2 | 34.3 | 44.3 | 57.1 |
| Concept 1a. Signalized Expressway | 32.5 | 42.4 | 47.3 | 59.6 |
| Concept 1b. Roundabout Expressway | 15.3 | 17.9 | 39.6 | 52.1 |
| Concept 1c. RCUT Expressway | 26.8 | 44.0 | 47.6 | 70.9 |
| Concept 1d. Interchange at Webster | 4.5 | 6.3 | 12.8 | 14.2 |

**Table 8. Total Peak Hour Network Delay for the TH 14 Concepts**

| Concepts | 2020 Network Delay (Hours) | | 2040 Network Delay (Hours) | |
|---|---|---|---|---|
| | AM Peak | PM Peak | AM Peak | PM Peak |
| No Build/Existing Condition | 10.3 | 14.8 | 70.8 | 105.3 |
| Concept 2a. Full Cloverleaf Interchange | 9.0 | 13.2 | 17.1 | 28.9 |
| Concept 2c. Eliminate South Loop - Signal | 22.0 | 27.6 | 36.7 | 48.1 |
| Concept 2d. Diverging Diamond | 25.6 | 29.7 | 36.6 | 48.9 |
| Concept 2f. Signalize EB TH 14 Exit Ramp | 12.6 | 16.7 | 22.6 | 32.7 |

**Table 7** indicates that concepts 1b and 1d would lower the total network delay compared to the existing condition during the 2020 and 2040 peak hours, where concepts 1a and 1c would increase network delay compared to the no build scenario. **Table 8** indicates that all TH 14 concepts except concept 2a would increase total network delay compared to the existing condition during the 2020 peak hour. However, during the 2040 peak hours the no build scenario delay is anticipated to be significantly worse so by 2040 all concepts are assumed to operate with less delay than the no build scenario.

The AM peak hour was assumed to account for 8% of the daily total and the PM peak hour was assumed to account for 10% of the daily total. Therefore, the total daily delay was estimated using the following equation.

$$\boldsymbol{Total\ Daily\ Delay} = \frac{\boldsymbol{AM\ Network\ Delay} + \boldsymbol{PM\ Network\ Delay}}{(\mathbf{0.08}+\mathbf{0.10})}$$

Auto delay and truck delay values were computed using the truck percentage (6.6%). The 6.6% truck percentage was estimated from the most recent heavy commercial count along TH 169 south of TH 14. The following values of travel time savings per person-hour were taken from Table A.1 of MnDOTs recommended standard values for use in cost effectiveness and benefit-cost analysis:

- $20.30 for autos
- $33.00 for trucks

Benefits from the reduction of delay were computed for the various concepts by comparing the total delay values for the concepts to the no build scenario. The total benefit over the 20-year analysis period can be determined using the 2020 and 2040 benefits. Assuming the delay benefits increased over the analysis period with a discount rate of 1.0%, the following formula was used to convert to a present value total delay benefit:

$$\boldsymbol{Total\ Delay\ Benefit} =$$

$$(\mathbf{2020}\ \boldsymbol{Benefit}) + \mathbf{17.2} * (\mathbf{2020}\ \boldsymbol{Benefit}) + \mathbf{150} * \frac{(\mathbf{2040}\ \boldsymbol{Benefit} - \mathbf{2020}\ \boldsymbol{Benefit})}{\mathbf{19}}$$

The formula was developed by assuming a uniform series of the 2020 benefit over the 20-year analysis period with the addition of a uniform gradient benefit (the additional benefit gained every year until the full 2040 benefit is reached). See **Tables 9** and **10** for the total delay benefits for each concept.

**Table 9. Delay Benefits for Lind/River/Webster Concepts**

| Concepts | Delay Benefit |
|---|---|
| Concept 1a. Signalized Expressway | $ (9,762,231) |
| Concept 1b. Roundabout Expressway | $ 19,284,962 |
| Concept 1c. RCUT Expressway | $ (16,013,057) |
| Concept 1d. Interchange at Webster | $ 74,206,498 |

**Table 10. Delay Benefits for TH 14 Concepts**

| Concepts | Delay Benefit |
|---|---|
| Concept 2a. Full Cloverleaf Interchange | $ 91,765,194 |
| Concept 2c. Eliminate South Loop - Signal | $ 52,640,901 |
| Concept 2d. Diverging Diamond | $ 49,628,565 |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ 82,151,540 |

Delay benefits for the concepts 1a and 1c were found to be negative as delay is increased overall with these options.

# Project Cost

Planning level cost estimates were calculated for each alternative. The cost estimates shown are in 2022 dollars and include 20% contingency and 20% for design and construction engineering fees. The cost of right of way was included only for concepts that require full property takes as concepts drawings were completed at a planning level and exact property impacts is unknown. Only concepts 1d and 2a were assumed to have full property takes based on the planning level concepts. The cost of acquiring the properties was assumed to be three times the current market value of the property. For concept 1d, six of the properties adjacent to the existing TH 169 and Webster Ave intersection were assumed to be acquired. For concept 2a, only one property was assumed to be acquired. The impacted properties can be seen on the concept figure for concept 2a and 1d in **Appendix B**. The construction and right of way acquisition costs are shown in **Table 11** below. A lower and higher end cost is shown for concept 2a. The lower end cost assumes the interchange remains within the flood zone (which is the existing condition). The higher end cost raises TH 169 and the TH 14 interchange to eliminate the flood zone issue so that TH 169 does not need to be closed and sand bagged when the Mississippi River water levels get too high.

**Table 11. Concept Cost Estimates**

| Concepts | Construction Cost | ROW Cost | Total Cost |
|---|---|---|---|
| Concept 1a. Signalized Expressway | $ 6,200,000 | $ - | $ 6,200,000 |
| Concept 1b. Roundabout Expressway | $ 7,300,000 | $ - | $ 7,300,000 |
| Concept 1c. RCUT Expressway | $ 8,600,000 | $ - | $ 8,600,000 |
| Concept 1d. Interchange at Webster | $ 25,000,000 | $ 4,430,700 | $ 29,431,000 |
| Concept 2a. Full Cloverleaf Interchange (lower end) | $ 14,000,000 | $ 3,078,300 | $ 17,079,000 |
| Concept 2a. Full Cloverleaf Interchange (higher end) | $ 23,000,000 | $ 3,078,300 | $ 26,079,000 |
| Concept 2c. Eliminate South Loop - Signal | $ 2,500,000 | $ - | $ 2,500,000 |
| Concept 2d. Diverging Diamond | $ 9,000,000 | $ - | $ 9,000,000 |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ 500,000 | $ - | $ 500,000 |

# Cost Benefit Summary

The present value of both safety and delay benefits are summarized in **Tables 12** and **13** along with concept-level cost estimates and the benefit to cost ratio. A ratio greater than one indicates the project cost is less than the anticipated benefit from the investment. A ratio lower than one, or a negative ratio, indicates the anticipated benefit does not offset the cost.

**Table 12. Benefit-Cost for Lind/River/Webster Concepts**

| Concepts | Safety Benefit | Delay Benefit | Total Cost | B/C Ratio |
|---|---|---|---|---|
| Concept 1a. Signalized Expressway | $ - | $ (9,762,231) | $ 3,700,000 | **-2.64** |
| Concept 1b. Roundabout Expressway | $ 386,419 | $ 19,284,962 | $ 7,300,000 | **2.69** |
| Concept 1c. RCUT Expressway | $ 7,798,000 | $ (16,013,057) | $ 8,600,000 | **-0.96** |
| Concept 1d. Interchange at Webster | $ 14,711,915 | $ 74,206,498 | $ 29,431,000 | **3.02** |

**Table 12** indicates that concepts 1b and 1d both have anticipated benefits that are higher than project costs. Since concepts 1a and 1c have benefit cost ratios less than one, the anticipated benefits do not offset the cost.

**Table 13. Benefit-Cost for TH 14 Concepts**

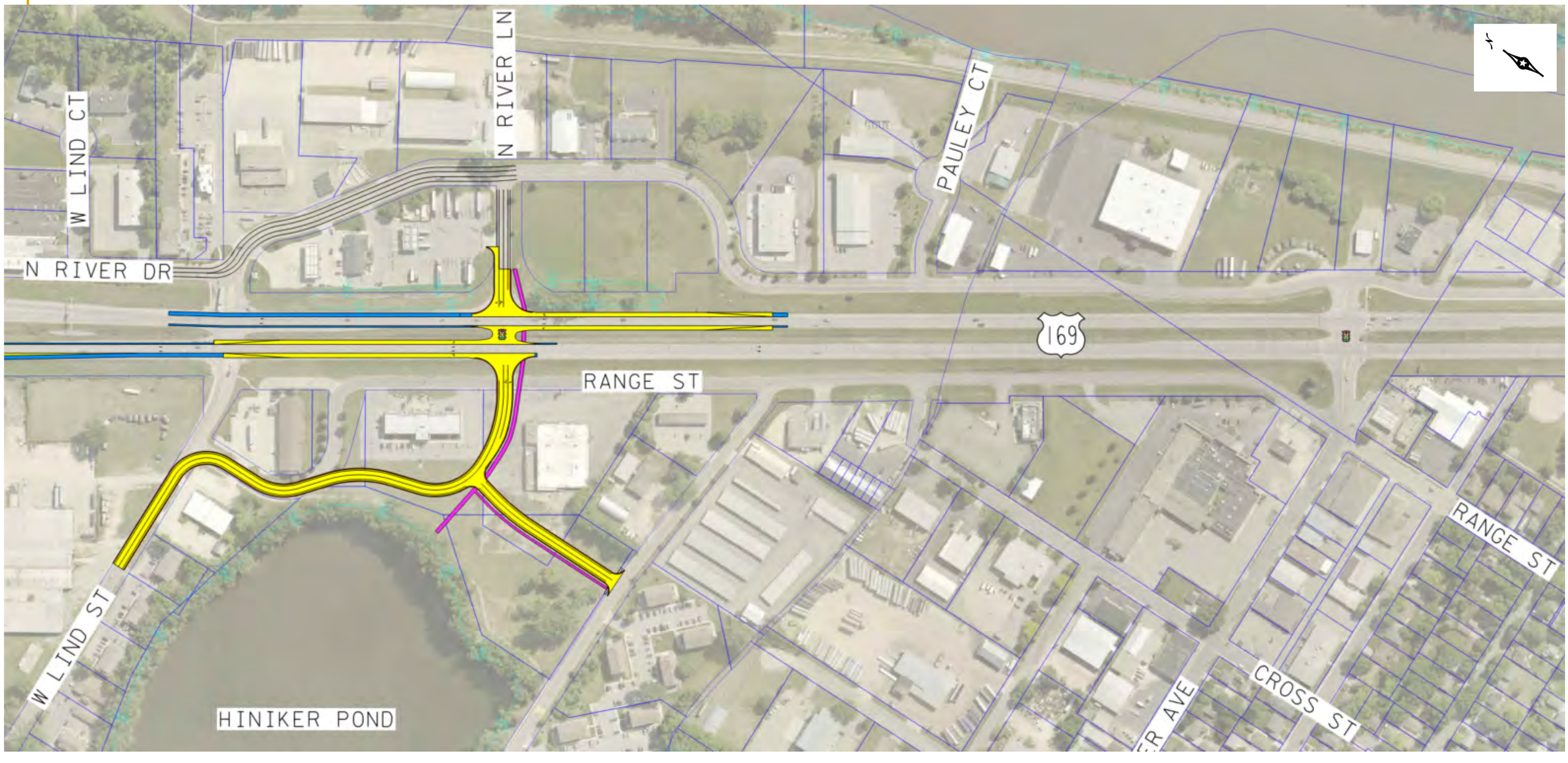
| Concepts | Safety Benefit | Delay Benefit | Total Cost | B/C Ratio |
|---|---|---|---|---|
| Concept 2a. Full Cloverleaf Interchange (lower end) | $ 2,458,951 | $ 91,765,194 | $ 17,079,000 | **5.52** |
| Concept 2a. Full Cloverleaf Interchange (higher end) | $ 2,458,951 | $ 91,765,194 | $ 26,079,000 | **3.61** |
| Concept 2c. Eliminate South Loop - Signal | $ (11,782,418) | $ 52,640,901 | $ 2,500,000 | **16.34** |
| Concept 2d. Diverging Diamond | $ (3,886,305) | $ 49,628,565 | $ 9,000,000 | **5.08** |
| Concept 2f. Signalize EB TH 14 Exit Ramp | $ (1,279,631) | $ 82,151,540 | $ 500,000 | **161.74** |

**Table 13** indicates that all of the TH 14 concepts have anticipated benefits that are higher than the project costs.

# BCA Memo Appendix

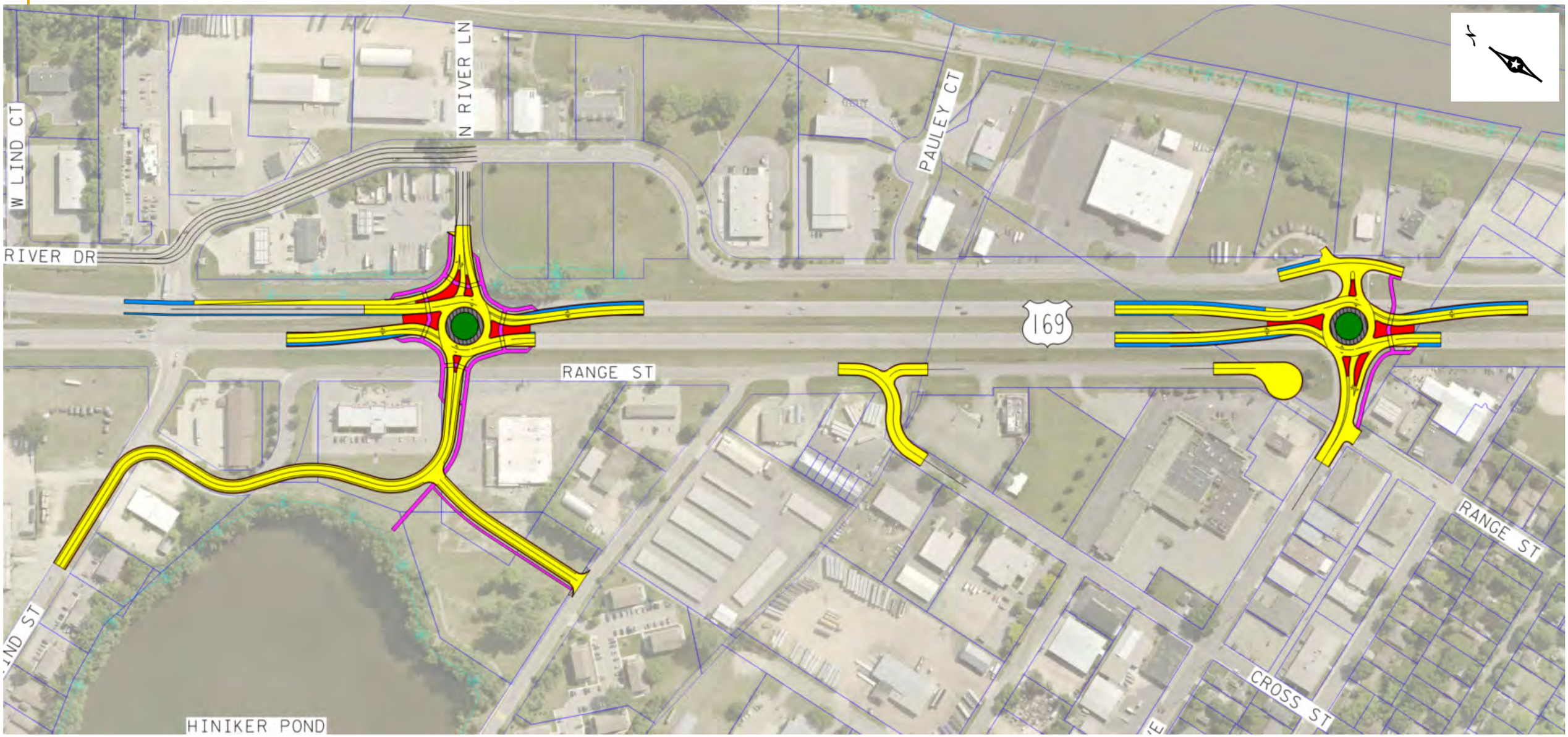
# Northern Subarea – N River Ln and Webster Ave

## Concept 1A – N River Ln and Webster Ave: Traffic Signal



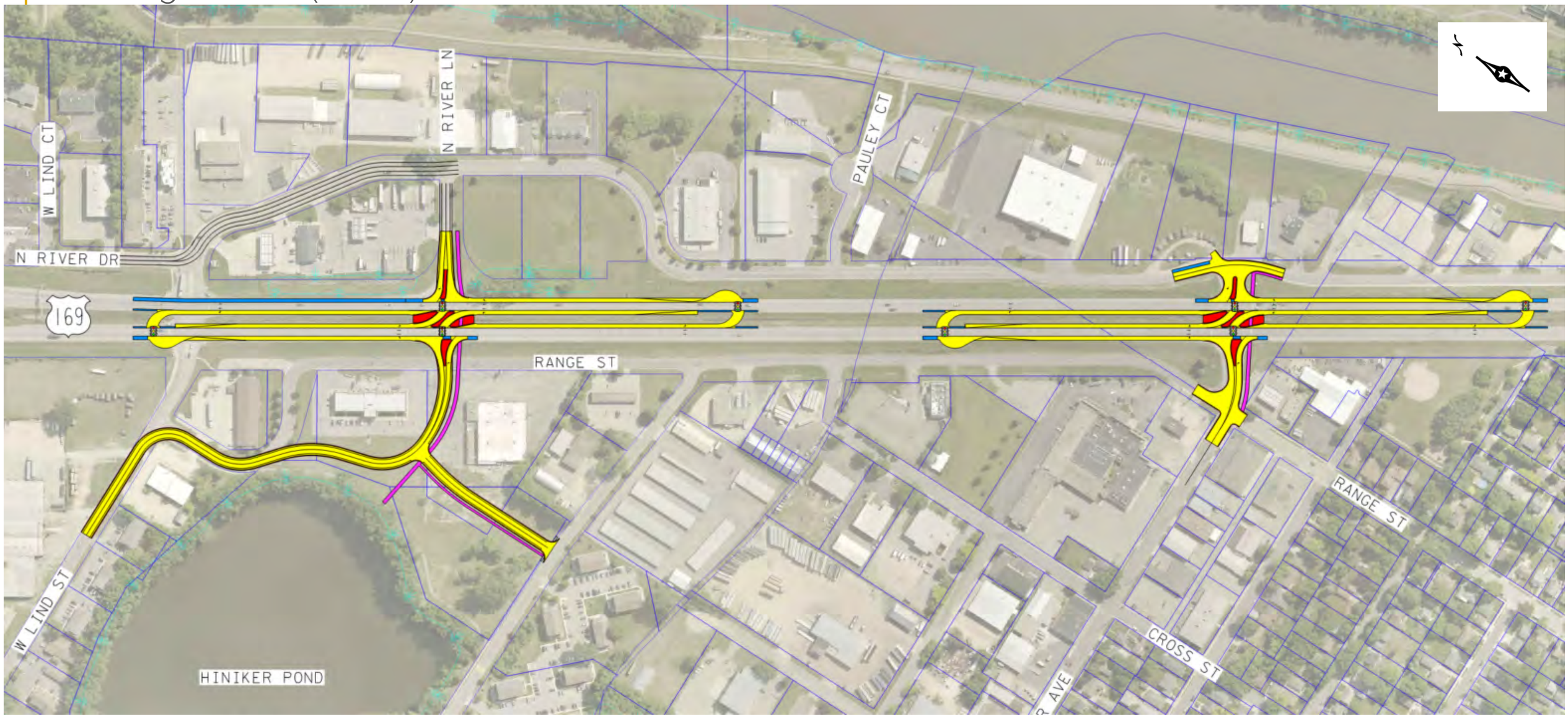
# Northern Subarea – N River Ln and Webster Ave

## Concept 1B – N River Ln and Webster Ave: Roundabouts



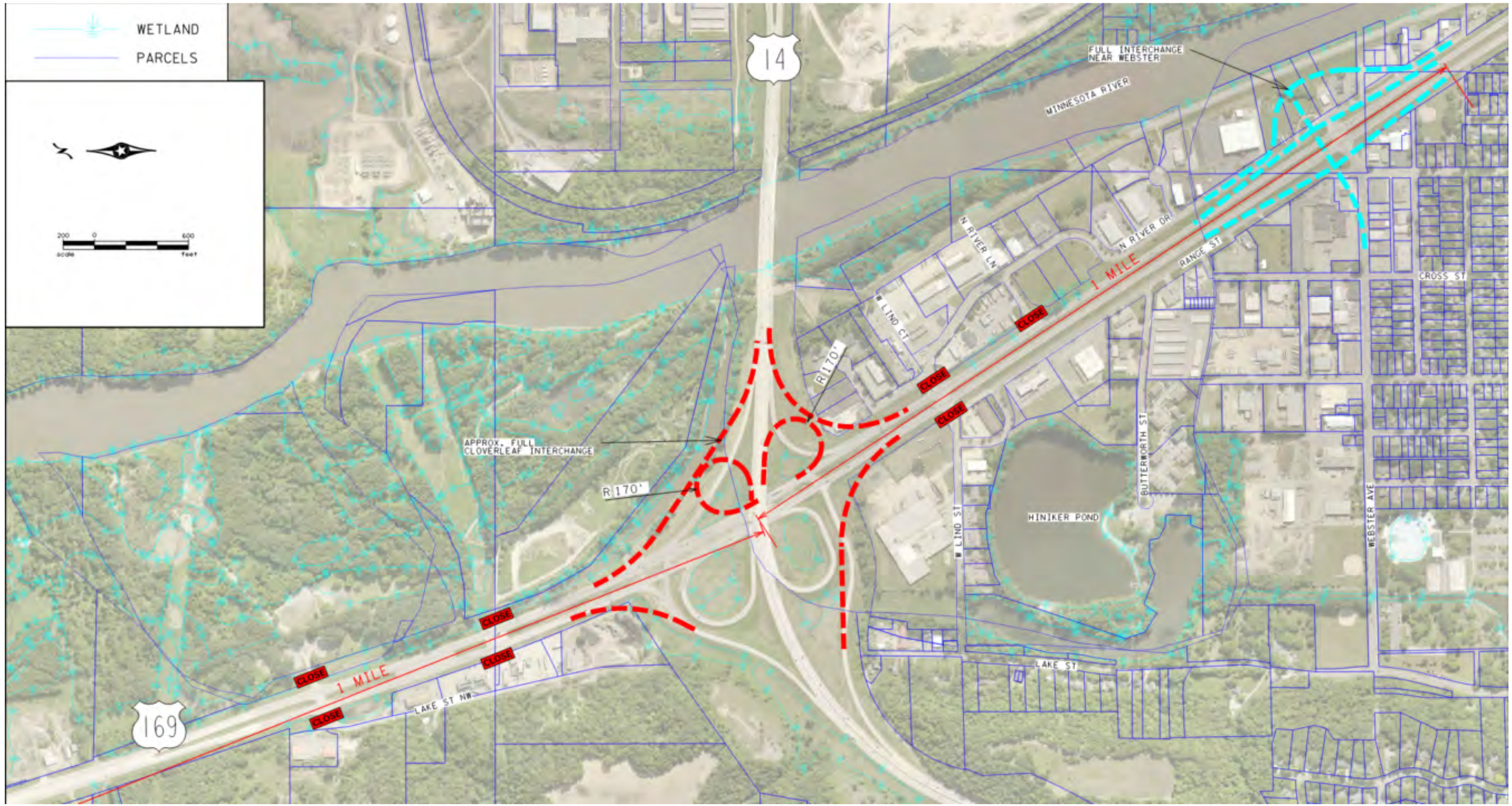
# Northern Subarea – N River Ln and Webster Ave

## Concept 1C – N River Ln and Webster Ave: Restricted Crossing U-Turn (RCUT) Intersections



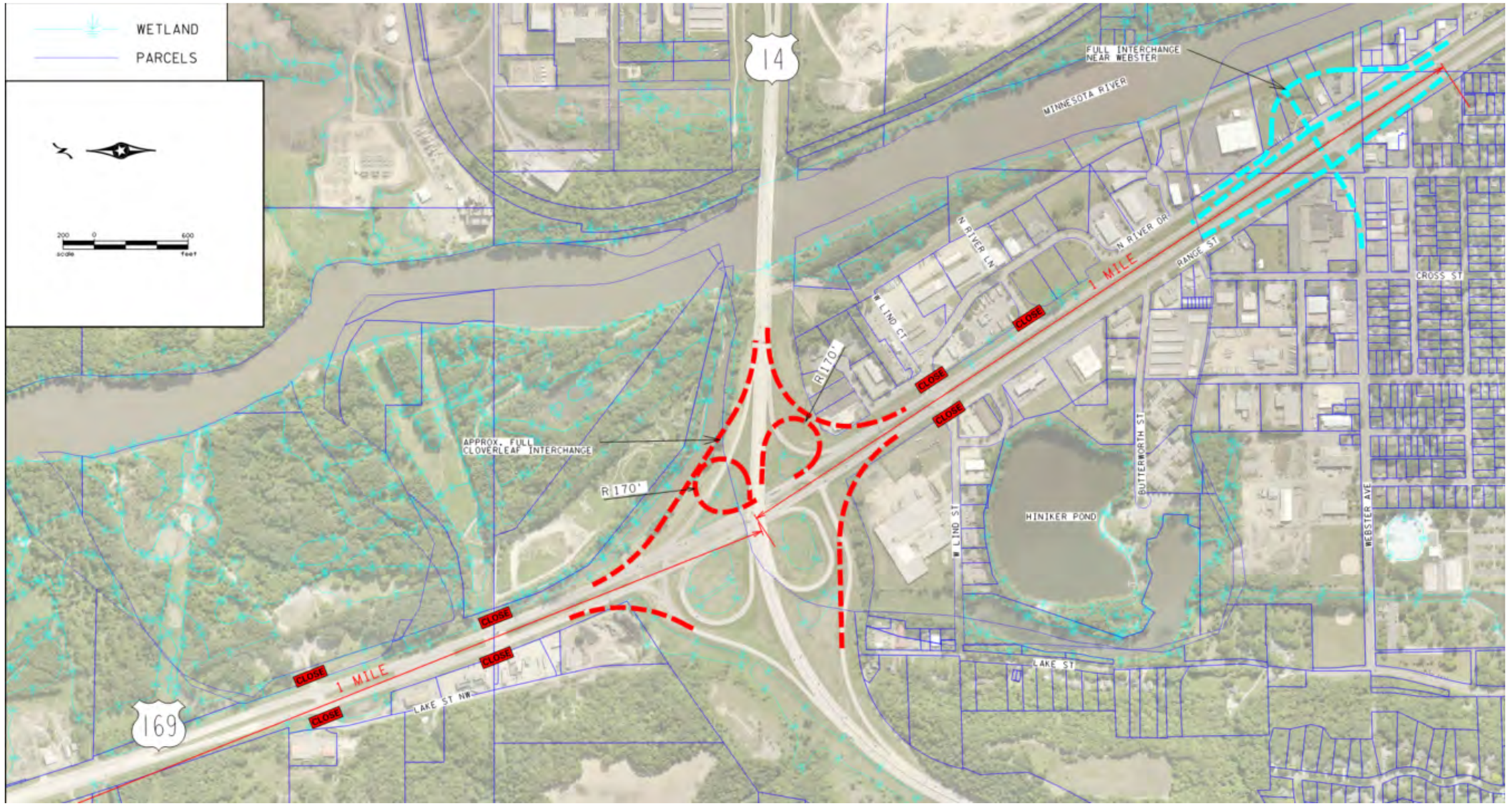
# Northern Subarea – Freeway Option

## Concept 1D – Hwy 169/14 Cloverleaf and Webster Ave Interchange



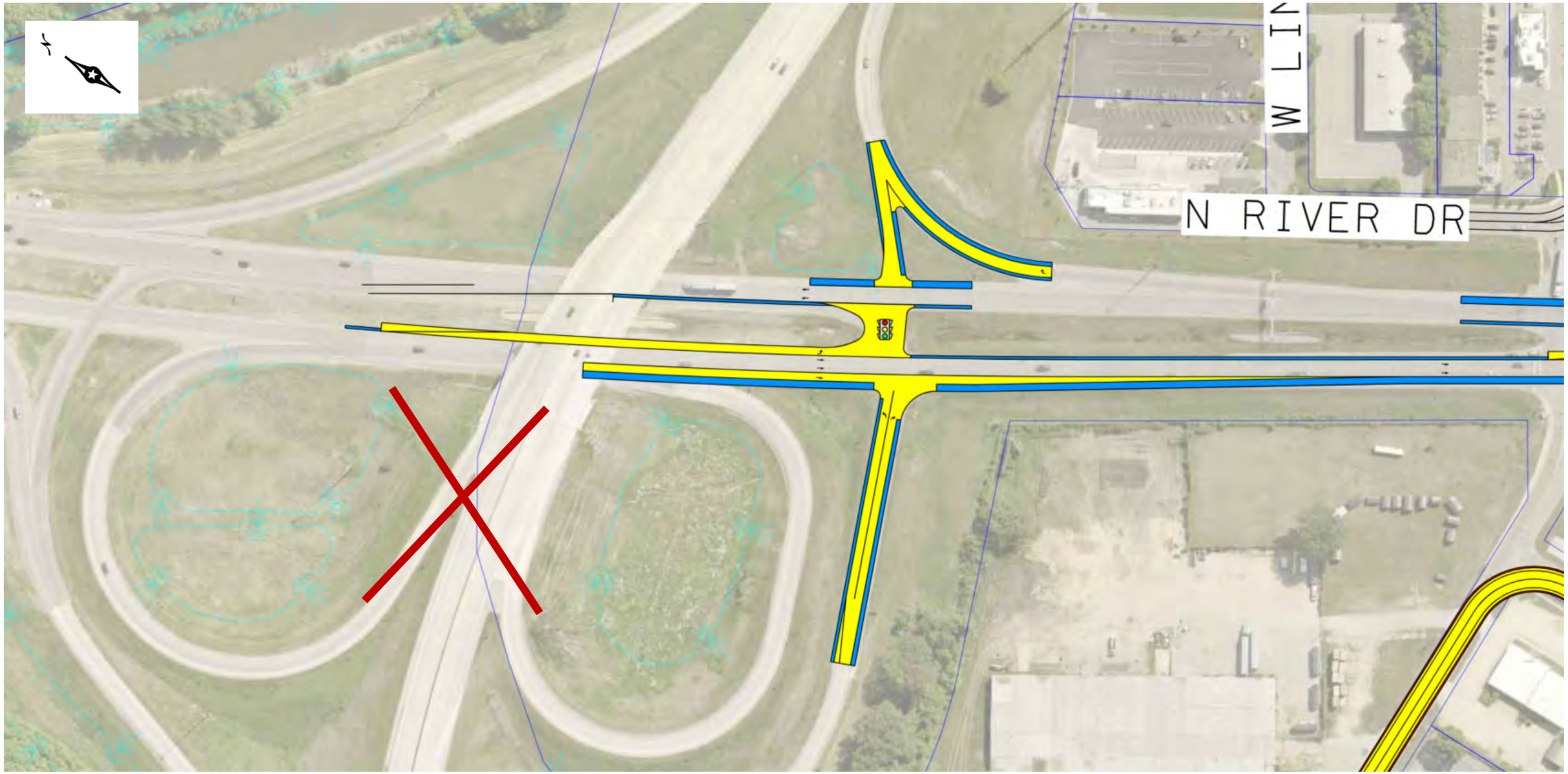
# Northern Subarea – Hwy 14 Interchange

## Concept 2A: Full Cloverleaf



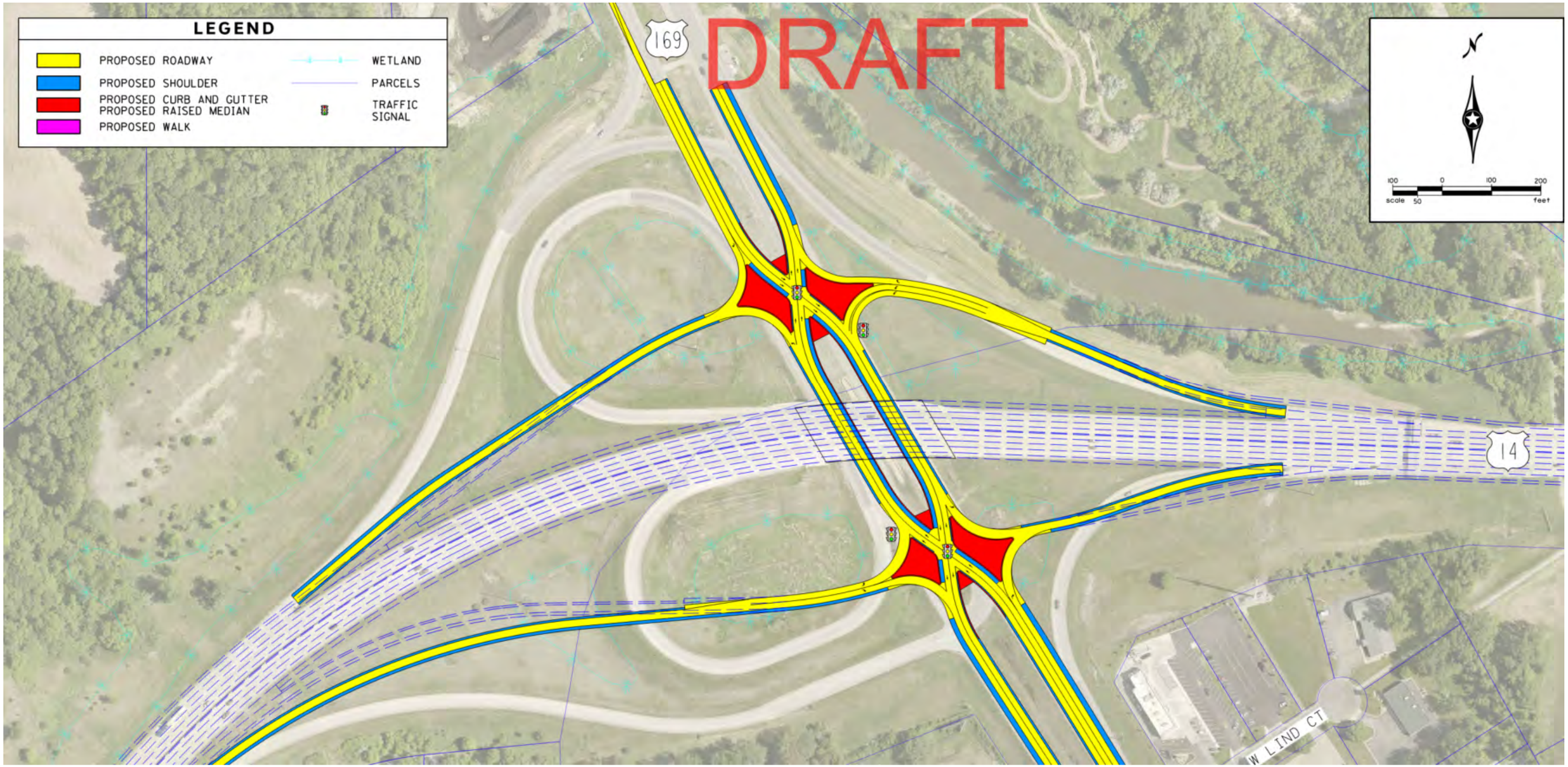
# Northern Subarea – Hwy 14 Interchange

## Concept 2C: Eliminate South Loop and Add Traffic Signal



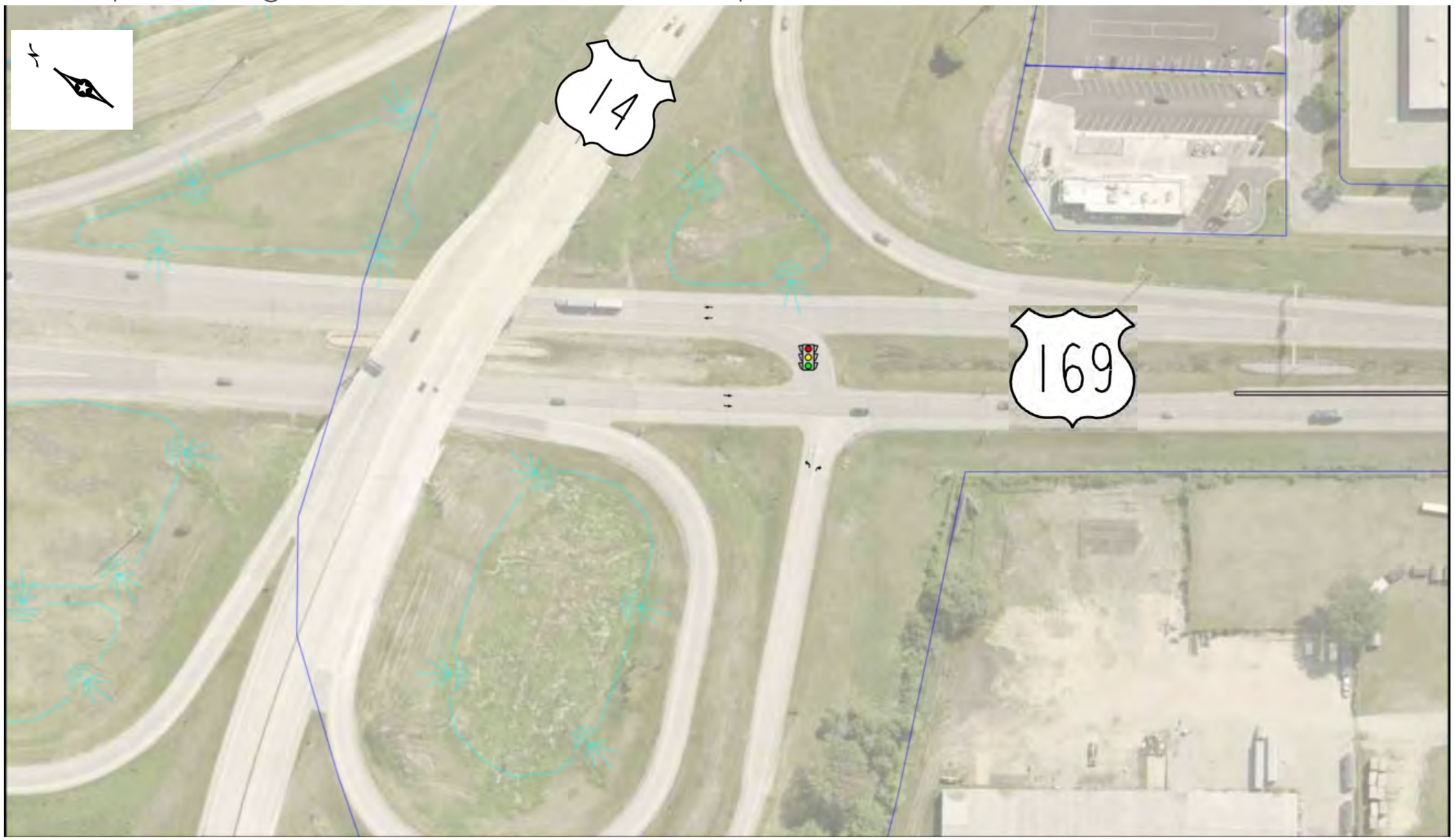
# Northern Subarea – Hwy 14 Interchange

## Concept 2D: Diverging Diamond



# Northern Subarea – Hwy 14 Interchange

## Concept 2F: Signalize EB TH 14 Exit Ramp at TH 169



# CMF / CRF Details

**CMF ID: 9157**

**Convert intersection to roundabout**

**Description:**

**Prior Condition:** ***No Prior Condition(s)***

**Category: Intersection geometry**

**Study:** ***Road safety effects of roundabouts: A meta-analysis*****, Elvik, R., 2017**

| | |
|---|---|
| **Star Quality Rating:** | ★★★★★ [View score details] |

| **Crash Modification Factor (CMF)** | |
|---|---|
| **Value:** | 0.56 |
| **Adjusted Standard Error:** | |
| **Unadjusted Standard Error:** | 0.043 |

| **Crash Reduction Factor (CRF)** | |
|---|---|
| **Value:** | 44 *(This value indicates a **decrease** in crashes)* |
| **Adjusted Standard Error:** | |
| **Unadjusted Standard Error:** | 4.34 |

## Applicability

| | |
|---|---|
| **Crash Type:** | All |
| **Crash Severity:** | A (serious injury),B (minor injury),C (possible injury) |
| **Roadway Types:** | Not specified |
| **Number of Lanes:** | |
| **Road Division Type:** | |
| **Speed Limit:** | |
| **Area Type:** | Not specified |
| **Traffic Volume:** | |
| **Time of Day:** | Not specified |

***If countermeasure is intersection-based***

| | |
|---|---|
| **Intersection Type:** | Not specified |
| **Intersection Geometry:** | Not specified |
| **Traffic Control:** | |
| **Major Road Traffic Volume:** | |
| **Minor Road Traffic Volume:** | |

## Development Details

| | |
|---|---|
| **Date Range of Data Used:** | 1975 to 2014 |
| **Municipality:** | |
| **State:** | No state(s) chosen. |
| **Country:** | Multiple countries |

| | |
|---|---|
| **Type of Methodology Used:** | 10 |
| **Sample Size Used:** | |

## Other Details

| | |
|---|---|
| **Included in Highway Safety Manual?** | No |
| **Date Added to Clearinghouse:** | Jan-17-2018 |
| **Comments:** | Includes single and double lane roundabouts |

---

This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center

# CMF / CRF Details

**CMF ID: 10084**

## Conversion of intersection to roundabout

**Description: Conversion of stop- and signal-controlled intersections into roundabouts**

**Prior Condition: Intersections without roundabouts**

**Category: Intersection geometry**

**Study: *Safety Evaluation of Roundabouts in Georgia*, Gbologah et al., 2019**

| | |
|---|---|
| **Star Quality Rating:** | ★★★☆☆ [View score details] |

| Crash Modification Factor (CMF) | |
|---|---|
| **Value:** | 0.642 |
| **Adjusted Standard Error:** | |
| **Unadjusted Standard Error:** | |

| Crash Reduction Factor (CRF) | |
|---|---|
| **Value:** | 35.8 *(This value indicates a **decrease** in crashes)* |
| **Adjusted Standard Error:** | |

| | |
|---|---|
| **Unadjusted Standard Error:** | |

## Applicability

| | |
|---|---|
| **Crash Type:** | All |
| **Crash Severity:** | All |
| **Roadway Types:** | Not specified |
| **Number of Lanes:** | |
| **Road Division Type:** | Undivided |
| **Speed Limit:** | |
| **Area Type:** | All |
| **Traffic Volume:** | |
| **Time of Day:** | All |

***If countermeasure is intersection-based***

| | |
|---|---|
| **Intersection Type:** | Roadway/roadway (not interchange related) |
| **Intersection Geometry:** | 4-leg |
| **Traffic Control:** | Not specified |
| **Major Road Traffic Volume:** | |
| **Minor Road Traffic Volume:** | |

## Development Details

| | |
|---|---|
| **Date Range of Data Used:** | 2007 to 2014 |
| **Municipality:** | |
| **State:** | GA |

| | |
|---|---|
| **Country:** | United States |
| **Type of Methodology Used:** | 2 |
| **Sample Size Used:** | |

## Other Details

| | |
|---|---|
| **Included in Highway Safety Manual?** | No |
| **Date Added to Clearinghouse:** | Jul-26-2019 |
| **Comments:** | Applies to the conversion of a four-leg intersection to a single-lane roundabout. CMF analysis omits roundabout locations with less than four average observed crashes per year in before period as one sample, roundabout locations with just a single data-year of crashes in before or after period, and roundabout locations with zero observed crashes in the before period. |

This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Roundabouts | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | A Study of the Traffic Safety at Roundabouts in Minnesota (2017) |
| | **Serious Injury (A) Crashes** | | |
| 0.64 | **Moderate Injury (B) Crashes** | **Crash Type** | All |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **All** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | | |
| A crashes | | |
| B crashes | 8 | |
| C crashes | | |
| PDO crashes | | |

## F. Benefit-Cost Calculation

| | |
|---|---|
| $2,465,255 | **Benefit (present value)** |
| $0 | **Cost** |

**B/C Ratio = N/A**

*Proposed project expected to reduce 1 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 2.88 | 0.58 | $120,960 |
| C crashes | 0.00 | 0.00 | $0 |
| PDO crashes | 0.00 | 0.00 | $0 |
| | | | **$120,960** |

## H. Amortized Benefit

**Total = $2,465,255**

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $120,960 | $120,960 |
| 2026 | $122,412 | $121,200 |
| 2027 | $123,880 | $121,440 |
| 2028 | $125,367 | $121,680 |
| 2029 | $126,871 | $121,921 |
| 2030 | $128,394 | $122,162 |
| 2031 | $129,935 | $122,404 |
| 2032 | $131,494 | $122,647 |
| 2033 | $133,072 | $122,890 |
| 2034 | $134,669 | $123,133 |
| 2035 | $136,285 | $123,377 |
| 2036 | $137,920 | $123,621 |
| 2037 | $139,575 | $123,866 |
| 2038 | $141,250 | $124,111 |
| 2039 | $142,945 | $124,357 |
| 2040 | $144,660 | $124,603 |
| 2041 | $146,396 | $124,850 |
| 2042 | $148,153 | $125,097 |
| 2043 | $149,931 | $125,345 |
| 2044 | $151,730 | $125,593 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Roundabouts | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | A Study of the Traffic Safety at Roundabouts in Minnesota (2017) |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | All |
| 0.90 | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **All** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | | |
| A crashes | | |
| B crashes | | |
| C crashes | 15 | |
| PDO crashes | | |

## F. Benefit-Cost Calculation

| | |
|---|---|
| $672,565 | **Benefit (present value)** |
| $0 | **Cost** |

**B/C Ratio = N/A**

*Proposed project expected to reduce 1 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

**Real Discount Rate** 1.0%

**Traffic Growth Rate** 1.2%

**Project Service Life** 20 years

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 0.00 | 0.00 | $0 |
| C crashes | 1.50 | 0.30 | $33,000 |
| PDO crashes | 0.00 | 0.00 | $0 |
| | | | **$33,000** |

## H. Amortized Benefit

**Total = $672,565**

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $33,000 | $33,000 |
| 2026 | $33,396 | $33,065 |
| 2027 | $33,797 | $33,131 |
| 2028 | $34,202 | $33,196 |
| 2029 | $34,613 | $33,262 |
| 2030 | $35,028 | $33,328 |
| 2031 | $35,448 | $33,394 |
| 2032 | $35,874 | $33,460 |
| 2033 | $36,304 | $33,526 |
| 2034 | $36,740 | $33,593 |
| 2035 | $37,181 | $33,659 |
| 2036 | $37,627 | $33,726 |
| 2037 | $38,079 | $33,793 |
| 2038 | $38,535 | $33,860 |
| 2039 | $38,998 | $33,927 |
| 2040 | $39,466 | $33,994 |
| 2041 | $39,939 | $34,061 |
| 2042 | $40,419 | $34,129 |
| 2043 | $40,904 | $34,196 |
| 2044 | $41,395 | $34,264 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Roundabouts | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | A Study of the Traffic Safety at Roundabouts in Minnesota (2017) |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | All |
| | **Possible Injury (C) Crashes** | | |
| 1.75 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **All** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 0 | |
| C crashes | 0 | |
| PDO crashes | 75 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| -$2,751,401 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce -12 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 0.00 | 0.00 | $0 |
| C crashes | 0.00 | 0.00 | $0 |
| PDO crashes | -56.25 | -11.25 | -$135,000 |
| | | | **-$135,000** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | -$135,000 | -$135,000 |
| 2026 | -$136,620 | -$135,267 |
| 2027 | -$138,259 | -$135,535 |
| 2028 | -$139,919 | -$135,804 |
| 2029 | -$141,598 | -$136,072 |
| 2030 | -$143,297 | -$136,342 |
| 2031 | -$145,016 | -$136,612 |
| 2032 | -$146,757 | -$136,882 |
| 2033 | -$148,518 | -$137,153 |
| 2034 | -$150,300 | -$137,425 |
| 2035 | -$152,103 | -$137,697 |
| 2036 | -$153,929 | -$137,970 |
| 2037 | -$155,776 | -$138,243 |
| 2038 | -$157,645 | -$138,517 |
| 2039 | -$159,537 | -$138,791 |
| 2040 | -$161,451 | -$139,066 |
| 2041 | -$163,389 | -$139,341 |
| 2042 | -$165,349 | -$139,617 |
| 2043 | -$167,334 | -$139,894 |
| 2044 | -$169,342 | -$140,171 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = -$2,751,401**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Restricted Crossing U-Turn | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.23 | **Fatal (K) Crashes** | **Reference** | 2017 MnDOT Study of the Traffic Safety at Reduced Conflict Intersections |
| 0.23 | **Serious Injury (A) Crashes** | | |
| 0.23 | **Moderate Injury (B) Crashes** | **Crash Type** | Angle |
| 0.23 | **Possible Injury (C) Crashes** | | |
| 0.23 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| Crash Severity | Angle | < optional 2nd CMF > |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 1 | |
| C crashes | 2 | |
| PDO crashes | 10 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $1,694,000 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 3 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.2% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 0.77 | 0.15 | $32,340 |
| C crashes | 1.54 | 0.31 | $33,880 |
| PDO crashes | 7.70 | 1.54 | $18,480 |
| | | | **$84,700** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $84,700 | $84,700 |
| 2026 | $85,716 | $84,700 |
| 2027 | $86,745 | $84,700 |
| 2028 | $87,786 | $84,700 |
| 2029 | $88,839 | $84,700 |
| 2030 | $89,905 | $84,700 |
| 2031 | $90,984 | $84,700 |
| 2032 | $92,076 | $84,700 |
| 2033 | $93,181 | $84,700 |
| 2034 | $94,299 | $84,700 |
| 2035 | $95,431 | $84,700 |
| 2036 | $96,576 | $84,700 |
| 2037 | $97,735 | $84,700 |
| 2038 | $98,908 | $84,700 |
| 2039 | $100,095 | $84,700 |
| 2040 | $101,296 | $84,700 |
| 2041 | $102,511 | $84,700 |
| 2042 | $103,741 | $84,700 |
| 2043 | $104,986 | $84,700 |
| 2044 | $106,246 | $84,700 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $1,694,000**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Restricted Crossing U-Turn | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.65 | **Fatal (K) Crashes** | **Reference** | MnDOT Tech Memo: Restricted Crossing U-Turn - Design and Implementation Guidance |
| 0.65 | **Serious Injury (A) Crashes** | | |
| 0.65 | **Moderate Injury (B) Crashes** | **Crash Type** | All |
| 0.65 | **Possible Injury (C) Crashes** | | |
| 0.65 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **All** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 1 | |
| B crashes | 7 | |
| C crashes | 13 | |
| PDO crashes | 65 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $6,104,000 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 7 crashes annually, 1 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

**Real Discount Rate** 1.2%

**Traffic Growth Rate** 1.2%

**Project Service Life** 20 years

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.35 | 0.07 | $47,600 |
| B crashes | 2.45 | 0.49 | $102,900 |
| C crashes | 4.55 | 0.91 | $100,100 |
| PDO crashes | 22.75 | 4.55 | $54,600 |
| | | | **$305,200** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $305,200 | $305,200 |
| 2026 | $308,862 | $305,200 |
| 2027 | $312,569 | $305,200 |
| 2028 | $316,320 | $305,200 |
| 2029 | $320,115 | $305,200 |
| 2030 | $323,957 | $305,200 |
| 2031 | $327,844 | $305,200 |
| 2032 | $331,778 | $305,200 |
| 2033 | $335,760 | $305,200 |
| 2034 | $339,789 | $305,200 |
| 2035 | $343,866 | $305,200 |
| 2036 | $347,993 | $305,200 |
| 2037 | $352,169 | $305,200 |
| 2038 | $356,395 | $305,200 |
| 2039 | $360,671 | $305,200 |
| 2040 | $364,999 | $305,200 |
| 2041 | $369,379 | $305,200 |
| 2042 | $373,812 | $305,200 |
| 2043 | $378,298 | $305,200 |
| 2044 | $382,837 | $305,200 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $6,104,000**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Grade Separated Interchage with Roundabouts | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.24 | **Fatal (K) Crashes** | **Reference** | Highway Safety Manual and CMF ID 9157 |
| 0.24 | **Serious Injury (A) Crashes** | | |
| 0.24 | **Moderate Injury (B) Crashes** | **Crash Type** | All Injury Crashes |
| 0.24 | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| Crash Severity | All Injury Crashes | < optional 2nd CMF > |
|---|---|---|
| K crashes | 0 | |
| A crashes | 1 | |
| B crashes | 8 | |
| C crashes | 15 | |
| PDO crashes | 0 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $12,409,396 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 4 crashes annually, 1 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.76 | 0.15 | $103,251 |
| B crashes | 6.07 | 1.21 | $255,091 |
| C crashes | 11.39 | 2.28 | $250,536 |
| PDO crashes | 0.00 | 0.00 | $0 |
| | | | **$608,878** |

## H. Amortized Benefit

**Total = $12,409,396**

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $608,878 | $608,878 |
| 2026 | $616,185 | $610,084 |
| 2027 | $623,579 | $611,292 |
| 2028 | $631,062 | $612,503 |
| 2029 | $638,635 | $613,716 |
| 2030 | $646,298 | $614,931 |
| 2031 | $654,054 | $616,149 |
| 2032 | $661,903 | $617,369 |
| 2033 | $669,846 | $618,591 |
| 2034 | $677,884 | $619,816 |
| 2035 | $686,018 | $621,043 |
| 2036 | $694,251 | $622,273 |
| 2037 | $702,582 | $623,505 |
| 2038 | $711,012 | $624,740 |
| 2039 | $719,545 | $625,977 |
| 2040 | $728,179 | $627,217 |
| 2041 | $736,917 | $628,459 |
| 2042 | $745,760 | $629,703 |
| 2043 | $754,709 | $630,950 |
| 2044 | $763,766 | $632,200 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | Intersections of TH 169/Lind St/River Ln and TH 169/Webster Ave | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Grade Separated Interchage with Roundabouts | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | Highway Safety Manual and CMF ID 10084 |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | All |
| | **Possible Injury (C) Crashes** | | |
| 0.37 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **All** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 0 | |
| C crashes | 0 | |
| PDO crashes | 75 | |

## F. Benefit-Cost Calculation

| | |
|---|---|
| $2,302,519 | **Benefit (present value)** |
| $0 | **Cost** |

**B/C Ratio = N/A**

*Proposed project expected to reduce 10 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 0.00 | 0.00 | $0 |
| C crashes | 0.00 | 0.00 | $0 |
| PDO crashes | 47.07 | 9.41 | $112,975 |
| | | | **$112,975** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $112,975 | $112,975 |
| 2026 | $114,331 | $113,199 |
| 2027 | $115,703 | $113,423 |
| 2028 | $117,091 | $113,648 |
| 2029 | $118,496 | $113,873 |
| 2030 | $119,918 | $114,098 |
| 2031 | $121,357 | $114,324 |
| 2032 | $122,814 | $114,551 |
| 2033 | $124,287 | $114,777 |
| 2034 | $125,779 | $115,005 |
| 2035 | $127,288 | $115,232 |
| 2036 | $128,816 | $115,461 |
| 2037 | $130,361 | $115,689 |
| 2038 | $131,926 | $115,918 |
| 2039 | $133,509 | $116,148 |
| 2040 | $135,111 | $116,378 |
| 2041 | $136,732 | $116,608 |
| 2042 | $138,373 | $116,839 |
| 2043 | $140,034 | $117,071 |
| 2044 | $141,714 | $117,302 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $2,302,519**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Convert to Full Cloverleaf Interchange | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.50 | **Fatal (K) Crashes** | **Reference** | Based on change in crossing conflict points |
| 0.50 | **Serious Injury (A) Crashes** | | |
| 0.50 | **Moderate Injury (B) Crashes** | **Crash Type** | Angle |
| 0.50 | **Possible Injury (C) Crashes** | | |
| 0.50 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| Crash Severity | Angle | < optional 2nd CMF > |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 3 | |
| C crashes | 5 | |
| PDO crashes | 3 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $2,468,951 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 2 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 1.50 | 0.30 | $63,000 |
| C crashes | 2.50 | 0.50 | $55,000 |
| PDO crashes | 1.50 | 0.30 | $3,600 |
| | | | **$121,600** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $121,600 | $121,600 |
| 2026 | $123,011 | $121,793 |
| 2027 | $124,437 | $121,986 |
| 2028 | $125,881 | $122,179 |
| 2029 | $127,341 | $122,372 |
| 2030 | $128,818 | $122,566 |
| 2031 | $130,313 | $122,760 |
| 2032 | $131,824 | $122,955 |
| 2033 | $133,353 | $123,150 |
| 2034 | $134,900 | $123,345 |
| 2035 | $136,465 | $123,540 |
| 2036 | $138,048 | $123,736 |
| 2037 | $139,650 | $123,932 |
| 2038 | $141,269 | $124,128 |
| 2039 | $142,908 | $124,325 |
| 2040 | $144,566 | $124,522 |
| 2041 | $146,243 | $124,719 |
| 2042 | $147,939 | $124,917 |
| 2043 | $149,655 | $125,114 |
| 2044 | $151,391 | $125,313 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $2,468,951**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Traffic Signal at EB TH 14 Ramp and TH 169, Eliminate SB to EB Loop Ramp | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 2.50 | **Fatal (K) Crashes** | **Reference** | Based on change in crossing conflict points |
| 2.50 | **Serious Injury (A) Crashes** | | |
| 2.50 | **Moderate Injury (B) Crashes** | **Crash Type** | Angle |
| 2.50 | **Possible Injury (C) Crashes** | | |
| 2.50 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| Crash Severity | Angle | < optional 2nd CMF > |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 3 | |
| C crashes | 5 | |
| PDO crashes | 3 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| -$7,406,852 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce -4 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | -4.50 | -0.90 | -$189,000 |
| C crashes | -7.50 | -1.50 | -$165,000 |
| PDO crashes | -4.50 | -0.90 | -$10,800 |
| | | | **-$364,800** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | -$364,800 | -$364,800 |
| 2026 | -$369,032 | -$365,378 |
| 2027 | -$373,312 | -$365,957 |
| 2028 | -$377,643 | -$366,536 |
| 2029 | -$382,024 | -$367,117 |
| 2030 | -$386,455 | -$367,699 |
| 2031 | -$390,938 | -$368,281 |
| 2032 | -$395,473 | -$368,865 |
| 2033 | -$400,060 | -$369,449 |
| 2034 | -$404,701 | -$370,034 |
| 2035 | -$409,395 | -$370,620 |
| 2036 | -$414,144 | -$371,208 |
| 2037 | -$418,949 | -$371,796 |
| 2038 | -$423,808 | -$372,385 |
| 2039 | -$428,725 | -$372,974 |
| 2040 | -$433,698 | -$373,565 |
| 2041 | -$438,729 | -$374,157 |
| 2042 | -$443,818 | -$374,750 |
| 2043 | -$448,966 | -$375,343 |
| 2044 | -$454,174 | -$375,938 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = -$7,406,852**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Traffic Signal at EB TH 14 Ramp and TH 169, Eliminate SB to EB Loop Ramp | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 2.13 | **Fatal (K) Crashes** | **Reference** | Based on change in merging conflict points |
| 2.13 | **Serious Injury (A) Crashes** | | |
| 2.13 | **Moderate Injury (B) Crashes** | **Crash Type** | Sideswipe |
| 2.13 | **Possible Injury (C) Crashes** | | |
| 2.13 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **Sideswipe** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 0 | |
| C crashes | 0 | |
| PDO crashes | 2 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| -$110,129 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce -1 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 0.00 | 0.00 | $0 |
| C crashes | 0.00 | 0.00 | $0 |
| PDO crashes | -2.26 | -0.45 | -$5,424 |
| | | | **-$5,424** |

## H. Amortized Benefit

**Total = -$110,129**

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | -$5,424 | -$5,424 |
| 2026 | -$5,487 | -$5,433 |
| 2027 | -$5,551 | -$5,441 |
| 2028 | -$5,615 | -$5,450 |
| 2029 | -$5,680 | -$5,458 |
| 2030 | -$5,746 | -$5,467 |
| 2031 | -$5,813 | -$5,476 |
| 2032 | -$5,880 | -$5,484 |
| 2033 | -$5,948 | -$5,493 |
| 2034 | -$6,017 | -$5,502 |
| 2035 | -$6,087 | -$5,511 |
| 2036 | -$6,158 | -$5,519 |
| 2037 | -$6,229 | -$5,528 |
| 2038 | -$6,301 | -$5,537 |
| 2039 | -$6,374 | -$5,546 |
| 2040 | -$6,448 | -$5,554 |
| 2041 | -$6,523 | -$5,563 |
| 2042 | -$6,599 | -$5,572 |
| 2043 | -$6,675 | -$5,581 |
| 2044 | -$6,753 | -$5,590 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Convert to Diverging Diamond Interchange | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 3.25 | **Fatal (K) Crashes** | **Reference** | Based on change in crossing conflict points |
| 3.25 | **Serious Injury (A) Crashes** | | |
| 3.25 | **Moderate Injury (B) Crashes** | **Crash Type** | Angle |
| 3.25 | **Possible Injury (C) Crashes** | | |
| 3.25 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| Crash Severity | Angle | < optional 2nd CMF > |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 3 | |
| C crashes | 5 | |
| PDO crashes | 3 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| -$11,110,278 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce -5 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | -6.75 | -1.35 | -$283,500 |
| C crashes | -11.25 | -2.25 | -$247,500 |
| PDO crashes | -6.75 | -1.35 | -$16,200 |
| | | | **-$547,200** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | -$547,200 | -$547,200 |
| 2026 | -$553,548 | -$548,067 |
| 2027 | -$559,969 | -$548,935 |
| 2028 | -$566,464 | -$549,805 |
| 2029 | -$573,035 | -$550,676 |
| 2030 | -$579,683 | -$551,548 |
| 2031 | -$586,407 | -$552,422 |
| 2032 | -$593,209 | -$553,297 |
| 2033 | -$600,090 | -$554,173 |
| 2034 | -$607,051 | -$555,051 |
| 2035 | -$614,093 | -$555,931 |
| 2036 | -$621,217 | -$556,811 |
| 2037 | -$628,423 | -$557,693 |
| 2038 | -$635,713 | -$558,577 |
| 2039 | -$643,087 | -$559,462 |
| 2040 | -$650,547 | -$560,348 |
| 2041 | -$658,093 | -$561,236 |
| 2042 | -$665,727 | -$562,125 |
| 2043 | -$673,449 | -$563,015 |
| 2044 | -$681,261 | -$563,907 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = -$11,110,278**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Convert to Diverging Diamond Interchange | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 2.13 | **Fatal (K) Crashes** | **Reference** | Based on change in merging conflict points |
| 2.13 | **Serious Injury (A) Crashes** | | |
| 2.13 | **Moderate Injury (B) Crashes** | **Crash Type** | Sideswipe |
| 2.13 | **Possible Injury (C) Crashes** | | |
| 2.13 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **Sideswipe** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 0 | |
| C crashes | 0 | |
| PDO crashes | 2 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| -$110,129 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce -1 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 0.00 | 0.00 | $0 |
| C crashes | 0.00 | 0.00 | $0 |
| PDO crashes | -2.26 | -0.45 | -$5,424 |
| | | | **-$5,424** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | -$5,424 | -$5,424 |
| 2026 | -$5,487 | -$5,433 |
| 2027 | -$5,551 | -$5,441 |
| 2028 | -$5,615 | -$5,450 |
| 2029 | -$5,680 | -$5,458 |
| 2030 | -$5,746 | -$5,467 |
| 2031 | -$5,813 | -$5,476 |
| 2032 | -$5,880 | -$5,484 |
| 2033 | -$5,948 | -$5,493 |
| 2034 | -$6,017 | -$5,502 |
| 2035 | -$6,087 | -$5,511 |
| 2036 | -$6,158 | -$5,519 |
| 2037 | -$6,229 | -$5,528 |
| 2038 | -$6,301 | -$5,537 |
| 2039 | -$6,374 | -$5,546 |
| 2040 | -$6,448 | -$5,554 |
| 2041 | -$6,523 | -$5,563 |
| 2042 | -$6,599 | -$5,572 |
| 2043 | -$6,675 | -$5,581 |
| 2044 | -$6,753 | -$5,590 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = -$110,129**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 at Lind St | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | N/A - Rear End Crashes at Lind for Comparison | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.00 | **Fatal (K) Crashes** | **Reference** | Based on change in mainline delay (comparing Lind to TH 14) |
| 0.00 | **Serious Injury (A) Crashes** | | |
| 0.00 | **Moderate Injury (B) Crashes** | **Crash Type** | Rear End |
| 0.00 | **Possible Injury (C) Crashes** | | |
| 0.00 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT (Rear End Crashes at Lind) | | | |

| **Crash Severity** | **Rear End** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 4 | |
| C crashes | 11 | |
| PDO crashes | 48 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $10,663,593 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 13 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 4.00 | 0.80 | $168,000 |
| C crashes | 11.00 | 2.20 | $242,000 |
| PDO crashes | 48.00 | 9.60 | $115,200 |
| | | | **$525,200** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $525,200 | $525,200 |
| 2026 | $531,292 | $526,032 |
| 2027 | $537,455 | $526,865 |
| 2028 | $543,690 | $527,700 |
| 2029 | $549,997 | $528,536 |
| 2030 | $556,377 | $529,373 |
| 2031 | $562,831 | $530,212 |
| 2032 | $569,359 | $531,052 |
| 2033 | $575,964 | $531,893 |
| 2034 | $582,645 | $532,736 |
| 2035 | $589,404 | $533,580 |
| 2036 | $596,241 | $534,425 |
| 2037 | $603,157 | $535,271 |
| 2038 | $610,154 | $536,119 |
| 2039 | $617,232 | $536,969 |
| 2040 | $624,392 | $537,819 |
| 2041 | $631,635 | $538,671 |
| 2042 | $638,961 | $539,525 |
| 2043 | $646,373 | $540,379 |
| 2044 | $653,871 | $541,235 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $10,663,593**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Traffic Signal at EB TH 14 Ramp and TH 169, Eliminate SB to EB Loop Ramp | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.40 | **Fatal (K) Crashes** | **Reference** | Based on change in mainline delay (comparing Lind to TH 14) |
| 0.40 | **Serious Injury (A) Crashes** | | |
| 0.40 | **Moderate Injury (B) Crashes** | **Crash Type** | Rear End |
| 0.40 | **Possible Injury (C) Crashes** | | |
| 0.40 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **Rear End** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 4 | |
| C crashes | 11 | |
| PDO crashes | 48 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $6,398,156 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 8 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 2.40 | 0.48 | $100,800 |
| C crashes | 6.60 | 1.32 | $145,200 |
| PDO crashes | 28.80 | 5.76 | $69,120 |
| | | | **$315,120** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $315,120 | $315,120 |
| 2026 | $318,775 | $315,619 |
| 2027 | $322,473 | $316,119 |
| 2028 | $326,214 | $316,620 |
| 2029 | $329,998 | $317,122 |
| 2030 | $333,826 | $317,624 |
| 2031 | $337,698 | $318,127 |
| 2032 | $341,616 | $318,631 |
| 2033 | $345,578 | $319,136 |
| 2034 | $349,587 | $319,641 |
| 2035 | $353,642 | $320,148 |
| 2036 | $357,745 | $320,655 |
| 2037 | $361,894 | $321,163 |
| 2038 | $366,092 | $321,672 |
| 2039 | $370,339 | $322,181 |
| 2040 | $374,635 | $322,692 |
| 2041 | $378,981 | $323,203 |
| 2042 | $383,377 | $323,715 |
| 2043 | $387,824 | $324,228 |
| 2044 | $392,323 | $324,741 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $6,398,156**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Convert to Diverging Diamond Interchange | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.25 | **Fatal (K) Crashes** | **Reference** | Based on change in mainline delay (comparing Lind to TH 14) |
| 0.25 | **Serious Injury (A) Crashes** | | |
| 0.25 | **Moderate Injury (B) Crashes** | **Crash Type** | Rear End |
| 0.25 | **Possible Injury (C) Crashes** | | |
| 0.25 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT (Rear End Crashes at Lind) | | | |

| **Crash Severity** | **Rear End** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 4 | |
| C crashes | 11 | |
| PDO crashes | 48 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $7,997,695 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 10 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 3.00 | 0.60 | $126,000 |
| C crashes | 8.25 | 1.65 | $181,500 |
| PDO crashes | 36.00 | 7.20 | $86,400 |
| | | | **$393,900** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $393,900 | $393,900 |
| 2026 | $398,469 | $394,524 |
| 2027 | $403,091 | $395,149 |
| 2028 | $407,767 | $395,775 |
| 2029 | $412,497 | $396,402 |
| 2030 | $417,282 | $397,030 |
| 2031 | $422,123 | $397,659 |
| 2032 | $427,020 | $398,289 |
| 2033 | $431,973 | $398,920 |
| 2034 | $436,984 | $399,552 |
| 2035 | $442,053 | $400,185 |
| 2036 | $447,181 | $400,819 |
| 2037 | $452,368 | $401,454 |
| 2038 | $457,615 | $402,090 |
| 2039 | $462,924 | $402,727 |
| 2040 | $468,294 | $403,365 |
| 2041 | $473,726 | $404,004 |
| 2042 | $479,221 | $404,644 |
| 2043 | $484,780 | $405,285 |
| 2044 | $490,404 | $405,927 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $7,997,695**

**Traffic Safety Benefit-Cost Calculation**

Highway Safety Improvement Program (HSIP) Reactive Project

DEPARTMENT OF TRANSPORTATION

## A. Roadway Description

| | | | | | |
|---|---|---|---|---|---|
| **Route** | TH 169 | **District** | 7 | **County** | Nicollet |
| **Begin RP** | | **End RP** | | **Miles** | |
| **Location** | TH 169 - TH 14 Interchange | | | | |

## B. Project Description

| | | | |
|---|---|---|---|
| **Proposed Work** | Install Traffic Signal at EB TH 14 Ramp and TH 169 | | |
| **Project Cost*** | | **Installation Year** | 2025 |
| **Project Service Life** | 20 years | **Traffic Growth Factor** | 1.2% |

** exclude Right of Way from Project Cost*

## C. Crash Modification Factor

| | | | |
|---|---|---|---|
| 0.12 | **Fatal (K) Crashes** | **Reference** | Based on change in mainline delay (comparing Lind to TH 14) |
| 0.12 | **Serious Injury (A) Crashes** | | |
| 0.12 | **Moderate Injury (B) Crashes** | **Crash Type** | Rear End |
| 0.12 | **Possible Injury (C) Crashes** | | |
| 0.12 | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## D. Crash Modification Factor (optional second CMF)

| | | | |
|---|---|---|---|
| | **Fatal (K) Crashes** | **Reference** | |
| | **Serious Injury (A) Crashes** | | |
| | **Moderate Injury (B) Crashes** | **Crash Type** | |
| | **Possible Injury (C) Crashes** | | |
| | **Property Damage Only Crashes** | | www.CMFclearinghouse.org |

## E. Crash Data

| | | | | |
|---|---|---|---|---|
| **Begin Date** | 1/1/2015 | **End Date** | 12/31/2019 | 5 years |
| **Data Source** | MnDOT | | | |

| **Crash Severity** | **Rear End** | **< optional 2nd CMF >** |
|---|---|---|
| K crashes | 0 | |
| A crashes | 0 | |
| B crashes | 4 | |
| C crashes | 11 | |
| PDO crashes | 48 | |

## F. Benefit-Cost Calculation

| | | |
|---|---|---|
| $9,383,962 | **Benefit (present value)** | **B/C Ratio = N/A** |
| $0 | **Cost** | |

*Proposed project expected to reduce 12 crashes annually, 0 of which involving fatality or serious injury.*

## F. Analysis Assumptions

| Crash Severity | Crash Cost |
|---|---|
| K crashes | $1,360,000 |
| A crashes | $680,000 |
| B crashes | $210,000 |
| C crashes | $110,000 |
| PDO crashes | $12,000 |

**Link:** mndot.gov/planning/program/appendix_a.html

| | |
|---|---|
| **Real Discount Rate** | 1.0% |
| **Traffic Growth Rate** | 1.2% |
| **Project Service Life** | 20 years |

## G. Annual Benefit

| Crash Severity | Crash Reduction | Annual Reduction | Annual Benefit |
|---|---|---|---|
| K crashes | 0.00 | 0.00 | $0 |
| A crashes | 0.00 | 0.00 | $0 |
| B crashes | 3.52 | 0.70 | $147,840 |
| C crashes | 9.68 | 1.94 | $212,960 |
| PDO crashes | 42.24 | 8.45 | $101,376 |
| | | | **$462,176** |

## H. Amortized Benefit

| Year | Crash Benefits | Present Value |
|---|---|---|
| 2025 | $462,176 | $462,176 |
| 2026 | $467,537 | $462,908 |
| 2027 | $472,961 | $463,641 |
| 2028 | $478,447 | $464,376 |
| 2029 | $483,997 | $465,112 |
| 2030 | $489,611 | $465,848 |
| 2031 | $495,291 | $466,586 |
| 2032 | $501,036 | $467,326 |
| 2033 | $506,848 | $468,066 |
| 2034 | $512,728 | $468,807 |
| 2035 | $518,675 | $469,550 |
| 2036 | $524,692 | $470,294 |
| 2037 | $530,778 | $471,039 |
| 2038 | $536,935 | $471,785 |
| 2039 | $543,164 | $472,532 |
| 2040 | $549,465 | $473,281 |
| 2041 | $555,838 | $474,031 |
| 2042 | $562,286 | $474,782 |
| 2043 | $568,809 | $475,534 |
| 2044 | $575,407 | $476,287 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |
| 0 | $0 | $0 |

**Total = $9,383,962**

# Evaluation Memo Appendix G

IMPLEMENTATION PLAN

MAPO
MANKATO/NORTH MANKATO
AREA PLANNING ORGANIZATION

# MAPO Highway 169 Corridor Study

## Northern Subarea Implementation Plan

| Priority* | Timeframe | Section | Project Name or # | Project Description | Estimated 2022 Cost** and (Anticipated Build Year Cost) | Benefit Cost Ratio | Lead Agency | Cost Participation | Likely Funding Sources | Potential Competitive Funding Sources | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Short-Term 0 to 5 Years | 2021 - 2025 | Highway 14 interchange | Eastbound Ramp Signal | A standalone traditional signal system at the eastbound Highway 14 exit ramp intersection with Highway 169. | $500,000 | 161.74 | MnDOT | City of Mankato, City of North Mankato | TH, LOCAL | LPP, HSIP | Can be constructed as an independent standalone project to improve operations at the eastbound Highway 14 exit ramp intersection. |
| | | | | *Subtotal* | ***$500,000*** | | | | | | |
| Mid-term 6 to 15 Years | 2026 - 2030 | North River Lane to Webster Avenue | North River Lane and Webster Avenue Roundabouts or Signals | Closure of the Lind Street intersection with a new full access intersection (roundabout or signal) at North River Lane and reconstruction of the Webster Avenue intersection to either a roundabout or leave as signal control. Lind Street closure shall not occur before the new full access intersection at North River Lane is established. Closure of Lind Street and the new full access intersection at North River Lane will require a new local connection on the east side of Hiniker Pond from Lind Street to Butterworth Street and connecting to the North River Lane intersection with Highway 169. | $3.7-7.3M ($4.7-9.3M in 2027 $) | Roundabouts: 2.69 Signals: -2.64 | MnDOT | City of Mankato, City of North Mankato | TH, LOCAL | HSIP, LPP, LRIP,COC, MNHFP TED/TEDI, State Bonding Bill | The concept allows for further evaluation of a signal or roundabout control at each intersection. The public and PMT had preference for roundabout controls at each intersection. Either intersection control can be paired with the Eastbound Ramp Signal project or a future Highway 14/169 Diverging Diamond interchange.<br><br>Should be planned to be paired with MnDOT planned investments for 2027. |
| | | Webster Avenue intersection | Webster Avenue Intersection Modernization | Range Street remains open with modifications to lane striping/utilization on Webster Avenue and Range Street at the intersection. Closee Speedway driveway access to Webster Avenue. | $450,000 ($575,000 in 2027 $) | - | City of North Mankato | NA | LOCAL | LPP, HSIP | To be paired with the North River Lane and Webster Avenue Roundabouts or Signal project. While improvements to operations may occur this concept does not address safety issues to a degree that would make it competitive for funding. |
| | | Highway 14 interchange to Lind Street | Grade Separated Pedestrian Crossings of Highway 169 | Public support and evaluation scoring was strongest for the grade separated pedestrian crossing just north of the current Lind Street intersection because the surrounding amenities create pedestrian demand to cross near that location. However agency feedback recognized the benefit of utilizing the existing Highway 14 bridge if possible. | $4M ($5.9M in 2030 $) | - | MnDOT | City of Mankato, City of North Mankato | TH, LOCAL | LPP, TAP | If paired with a larger roadway reconstruction project the cost of a pedestrian grade separation could be included in a RAISE or INFRA request. More competitive funding options are available if paired with larger roadway project. |
| | | | | *Subtotal* | *$8.2-15.7M* | | | | | | |
| Opportunity / Development / Safety Driven | Illustrative | Highway 14 interchange | Diverging Diamond Interchange | Reconstruction of the existing Highway 14/169 partial cloverleaf interchange into a diverging diamond interchange with signalized ramp intersections. | $9M | 5.08 | MnDOT | City of Mankato, City of North Mankato | TH, LOCAL | RAISE, INFRA, COC, MNHFP TED, State Bonding Bill | Only needed with increased development and crash issues associated with the weaving created by the existing cloverleaf ramps. Could be paired with roundabouts or signals at North River Lane and Webster Ave. |
| | | Webster Avenue | Grade Separated Pedestrian Crossings of Highway 169 | Agency feedback recognized that a grade separated crossing could also be beneficial at Webster Avenue but would only be needed if pedestrian movements were not adequately accommodated on the Veteran's Memorial Bridge and a future Lind Street area pedestrian grade separation. | $5M | - | City of North Mankato | City of Mankato, MnDOT | TH, LOCAL | LPP, TAP | Should consider pedestrian improvements considered in 2025 Veterans Memorial Bridge project.<br><br>If paired with a larger roadway reconstruction project the cost of a pedestrian grade separation could be included in a RAISE or INFRA request. More competitive funding options are available if paired with larger roadway project. |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

*Timing of all projects dependent upon funding availability.

** All estimated costs are for individual improvements only and don't capture the full right-of-way and easement costs. Mid-term costs are inflated to an approximate build year as noted. Opportunity driven costs were not inflated since build year is unknown.

### FUNDING KEY

COC Corridors of Commerce Funds (State)

CO County State Aid Highway, County Sales Tax, Wheelage, or Other County Funds

HSIP Highway Safety Improvement Program Funds (Federal)

LOCAL City Funding MSAS or Township

LPP Local Partnership Program Funds (State)

LRIP Local Road Improvement Program Funds (State)

MHFP Minnesota Highway Freight Program Funds (State)

PRIV Private Funding / Development (Private)

SRTS Safe Routes to School

TAP Transportation Alternatives Program (Federal)

STP Surface Transportation Program Funds (Federal)

TE Transportation Enhancement Funds (Federal)

TED/I Transportation Economic Development (State)

TH Trunk Highway Funds (State)

RAISE Rebuilding American Infrastructure with Sustainability and Equity (Federal)

INFRA Infrastructure for Rebuilding America (Federal)

TRLF Transportation Revolving Loan Fund (Federal)

TBACK Turnback Funds (State)

# MAPO Highway 169 Corridor Study

## Southern Subarea Implementation Plan

| Priority* | Timeframe | Section | Project Name or # | Project Description | Estimated 2022 Cost** and (Anticipated Build Year Cost) | Lead Agency*** | Cost Participation | Likely Funding Sources | Potential Competitive Funding Sources | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| Short-Term 0 to 5 Years | 2021 - 2025 | 1 - Blue Earth River to County Highway 33 | 1D | Reduced conflict intersection at Amos Owen Lane with southbound to eastbound left removed and replaced with U-turn to the west of the intersection. Hawley Street is right-in/right-out.<br>OR<br>Full R-cut intersection at Amos Owen Lane with Hawley Street remaining open as it is today.<br>Green T with traffic signal, at CR 33, for eastbound and all left turning traffic (northbound to westbound left and westbound to southbound left). | $2.2M | MnDOT | South Bend Township, Blue Earth County, City of Mankato (with orderly annexation) | TH, LOCAL, CSAH, CO | LPP, HSIP, MNHFP, TED | The Amos Owen Lane and County Highway 33 improvements need to be paired together for full safety benefits. The Green T at County Highway 33 is necessary, prior to closure of Hawley Street, to provide for the displaced left turns onto and off of Hwy 169.<br>During the study, MnDOT expressed concern with the addition of a traffic signal at this location due to its rural, high-speed character. MnDOT will revisit this recommendation when a project becomes more imminent to determine if an at-grade Green-T intersection is recommended versus looking towards partial grade separation that would maintain free-flow conditions on Highway 169. |
| | | Hawley Street Pedestrian Bridge | Hawley Street Pedestrian Bridge | Pedestrian overpass across Highway 169/Hawley Street intersection with touchdowns at northwest to southeast quadrants, utilizing State of MN property (NW quadrant) and an undeveloped property (SW quadrant). | $5M | MnDOT | South Bend Township, Blue Earth County, City of Mankato (with orderly annexation) | TH, LOCAL, CO | DNR, TAP, LPP | High level project cost in 2023 dollars including engineering and contingency estimates. Does not include right-of-way costs for the parcel on the SE quadrant. |
| | | 2 - County Highway 33 to County Highway 90 | 2A | CR 120 acceleration lanes. | $660,000 | MnDOT | South Bend Township, Blue Earth County, City of Mankato (with orderly annexation) | TH, LOCAL, CO | LPP, HSIP | Can be constructed independently as an interim improvement prior to a Highway 68 High-T |
| | | | | | | | | | | |
| | | | | *Subtotal* | *$7.9M* | | | | | |
| Mid-term 6 to 15 Years | 2026 - 2030 | 2 - County Road 33 to County Highway 90 | 2A | High T at Highway 68. | $22.2M ($32.8M in 2030 $) | MnDOT | South Bend Township, Blue Earth County, City of Mankato (with orderly annexation) | TH, LOCAL, CO | HSIP, COC, TED,/TEDI State Bonding Bill | High T to be paired with larger Highway 68 reconstruction project, serving as a capacity building project to be completed prior to the project, and provide a detour for future Highway 14 construction. Alternatively, the project could be modified slightly and paired with 1C instead of 1D and allow for a full median at County Highway 33. Construction will not impact the existing Minneopa Trail Pedestrian Bridge. |
| | | | | CR 69 median closure and new local street connection to close multiple driveways on Highway 169. Convert CR 120 to R-cut. | | | | | | County Highway 69 improvements remove all left turns so they must occur after the Highway 68 High T which can replace those movements within this area. |
| | | 3- County Road 90 to 133th Lane | 3A | 208th Lane and Loren Drive access closures with new local road connections. | $1.9M ($2.8M in 2030 $) | MnDOT | South Bend Township, Blue Earth County, City of Mankato (with orderly annexation) | TH, LOCAL, CO | LPP, HSIP | 208th Lane and Loren Drive access closures must happen simultaneously or previous to the Highway 60 and Gadwall Road R-cut. |
| | | | | Reduced conflict intersection at Highway 60 at Highway 169 with northbound to westbound removed and replaced with U-turns | | | | | | |
| | | | | *Subtotal* | *$24.1-35.6M* | | | | | |
| Opportunity / Development / Safety Driven | Illustrative | 1 - Blue Earth River to County Highway 33 | 1D | Acceleration lane from Hawley Street to eastbound Highway 169 | $2.5M | MnDOT | TBD | TH | TBD | Time with a Blue Earth River Crossing bridge project. |
| | | 2 - County Highway 33 to County Highway 90 | 2C | CR 68 realignment with Highway 169 and extension of Southbend Ave (CR 69). Includes local driveway and median closures between Highway 68 and CR 69. | $9M | TBD | TBD | TH, LOCAL, CO | TBD | Could be warranted if new industrial, commercial, or residential developments occur. Current local plans do not show planned development that would require these improvements. |
| | | 3- County Highway 90 to 133th Lane | 3B | Full access intersection at Highway 60 and 169 with access closure at 208th Lane and new local road access. | $5M | TBD | TBD | TH, LOCAL, CO | TBD | Could be warranted if new industrial, commercial, or residential developments occur. Current local plans do not show planned development that would require these improvements. |
| | | | | Realignment and extension of Gadwall Road to a new full access intersection with Highway 169 east of the current intersection. Includes cul-de-sac of CR 117 and new local road connections for existing industrial properties. | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

**Timing of all projects dependent upon funding availability.*

*** All estimated costs are for individual improvements only and don't capture the full right-of-way and easement costs. Mid-term costs are inflated to an approximate build year as noted. Opportunity driven costs were not inflated since build year is unknown.*

**** Southern Subarea not currently in the MnDot Capital Highway Investment Plan (CHIP)*

### FUNDING KEY

COC Corridors of Commerce Funds (State)

CO County State Aid Highway, County Sales Tax, Wheelage, or Other County Funds

HSIP Highway Safety Improvement Program Funds (Federal)

LOCAL City Funding MSAS or Township

LPP Local Partnership Program Funds (State)

LRIP Local Road Improvement Program Funds (State)

MHFP Minnesota Highway Freight Program Funds (State)

PRIV Private Funding / Development (Private)

SRTS Safe Routes to School

TAP Transportation Alternatives Program (Federal)

STP Surface Transportation Program Funds (Federal)

TE Transportation Enhancement Funds (Federal)

TED/I Transportation Economic Development (State)

TH Trunk Highway Funds (State)

RAISE Rebuilding American Infrastructure with Sustainability and Equity (Federal)

TRLF Transportation Revolving Loan Fund (Federal)

TBACK Turnback Funds (State)